THE

FORTNIGHTLY REVIEW.

No. XXVI. New Series.—February 1, 1869.—Third Edition.

ON THE PHYSICAL BASIS OF LIFE.[1]

In order to make the title of this discourse generally intelligible, I have translated the term "Protoplasm," which is the scientific name of the substance of which I am about to speak, by the words "the physical basis of life." I suppose that, to many, the idea that there is such a thing as a physical basis, or matter, of life may be novel —so widely spread is the conception of life as a something which works through matter, but is independent of it; and even those who are aware that matter and life are inseparably connected, may not be prepared for the conclusion plainly suggested by the phrase, "*the* physical basis or matter of life," that there is some one kind of matter which is common to all living beings, and that their endless diversities are bound together by a physical, as well as an ideal, unity. In fact, when first apprehended, such a doctrine as this appears almost shocking to common sense.

What, truly, can seem to be more obviously different from one another in faculty, in form, and in substance, than the various kinds of living beings? What community of faculty can there be between the brightly-coloured lichen, which so nearly resembles a mere mineral incrustation of the bare rock on which it grows, and the painter, to whom it is instinct with beauty, or the botanist, whom it feeds with knowledge?

(1) The substance of this paper was contained in a discourse which was delivered in Edinburgh on the evening of Sunday, the 8th of November, 1868—being the first of a series of Sunday evening addresses upon non-theological topics, instituted by the Rev. J. Cranbrook. Some phrases, which could possess only a transitory and local interest, have been omitted; instead of the newspaper report of the Archbishop of York's address, his Grace's subsequently-published pamphlet "On the Limits of Philosophical Inquiry," is quoted; and I have, here and there, endeavoured to express my meaning more fully and clearly than I seem to have done in speaking—if I may judge by sundry criticisms upon what I am supposed to have said, which have appeared. But in substance, and, so far as my recollection serves, in form, what is here written corresponds with what was there said.

Again, think of the microscopic fungus—a mere infinitesimal ovoid particle, which finds space and duration enough to multiply into countless millions in the body of a living fly; and then of the wealth of foliage, the luxuriance of flower and fruit, which lies between this bald sketch of a plant and the giant pine of California, towering to the dimensions of a cathedral spire, or the Indian fig, which covers acres with its profound shadow, and endures while nations and empires come and go around its vast circumference? Or, turning to the other half of the world of life, picture to yourselves the great Finner whale, hugest of beasts that live, or have lived, disporting his eighty or ninety feet of bone, muscle, and blubber, with easy roll, among waves in which the stoutest ship that ever left dockyard would founder hopelessly; and contrast him with the invisible animalcules—mere gelatinous specks, multitudes of which could, in fact, dance upon the point of a needle with the same ease as the angels of the schoolmen could, in imagination. With these images before your minds, you may well ask what community of form, or structure, is there between the animalcule and the whale; or between the fungus and the fig tree? And, *à fortiori*, between all four?

Finally, if we regard substance, or material composition, what hidden bond can connect the flower which a girl wears in her hair and the blood which courses through her youthful veins; or, what is there in common between the dense and resisting mass of the oak, or the strong fabric of the tortoise, and those broad disks of glassy jelly which may be seen pulsating through the waters of a calm sea, but which drain away to mere films in the hand which raises them out of their element?

Such objections as these must, I think, arise in the mind of every one who ponders, for the first time, upon the conception of a single physical basis of life underlying all the diversities of vital existence; but I propose to demonstrate to you that, notwithstanding these apparent difficulties, a threefold unity—namely, a unity of power, or faculty, a unity of form, and a unity of substantial composition—does pervade the whole living world.

No very abstruse argumentation is needed, in the first place, to prove that the powers, or faculties, of all kinds of living matter, diverse as they may be in degree, are substantially similar in kind.

Goethe has condensed a survey of all the powers of mankind into the well known epigram:—

> "Warum treibt sich das Volk so und schreit? Es will sich ernähren,
> Kinder zeugen, und die nähren so gut es vermag.
> * * * * * *
> Weiter bringt es kein Mensch, stell' er sich wie er auch will."

In physiological language this means, that all the multifarious and complicated activities of man are comprehensible under three cate-

gories. Either they are immediately directed towards the maintenance and development of the body, or they effect transitory changes in the relative positions of parts of the body, or they tend towards the continuance of the species. Even those manifestations of intellect, of feeling, and of will, which we rightly name the higher faculties, are not excluded from this classification, inasmuch as to every one but the subject of them, they are known only as transitory changes in the relative positions of parts of the body. Speech, gesture, and every other form of human action are, in the long run, resolvable into muscular contraction, and muscular contraction is but a transitory change in the relative positions of the parts of a muscle. But the scheme which is large enough to embrace the activities of the highest form of life, covers all those of the lower creatures. The lowest plant, or animalcule, feeds, grows, and reproduces its kind. In addition, all animals manifest those transitory changes of form which we class under irritability and contractility; and, it is more than probable, that when the vegetable world is thoroughly explored, we shall find all plants in possession of the same powers, at one time or other of their existence.

I am not now alluding to such phenomena, at once rare and conspicuous, as those exhibited by the leaflets of the sensitive plant, or the stamens of the barberry, but to much more widely-spread, and, at the same time, more subtle and hidden, manifestations of vegetable contractility. You are doubtless aware that the common nettle owes its stinging property to the innumerable stiff and needle-like, though exquisitely delicate, hairs which cover its surface. Each stinging-needle tapers from a broad base to a slender summit, which, though rounded at the end, is of such microscopic fineness that it readily penetrates, and breaks off in, the skin. The whole hair consists of a very delicate outer case of wood, closely applied to the inner surface of which is a layer of semi-fluid matter, full of innumerable granules of extreme minuteness. This semi-fluid lining is protoplasm, which thus constitutes a kind of bag, full of a limpid liquid, and roughly corresponding in form with the interior of the hair which it fills. When viewed with a sufficiently high magnifying power, the protoplasmic layer of the nettle hair is seen to be in a condition of unceasing activity. Local contractions of the whole thickness of its substance pass slowly and gradually from point to point, and give rise to the appearance of progressive waves, just as the bending of successive stalks of corn by a breeze produces the apparent billows of a corn-field.

But, in addition to these movements, and independently of them, the granules are driven, in relatively rapid streams, through channels in the protoplasm which seem to have a considerable amount of persistence. Most commonly, the currents in adjacent parts of the protoplasm take similar directions; and, thus, there is a general stream up

one side of the hair and down the other. But this does not prevent the existence of partial currents which take different routes; and, sometimes, trains of granules may be seen coursing swiftly in opposite directions, within a twenty-thousandth of an inch of one another; while, occasionally, opposite streams come into direct collision, and, after a longer or shorter struggle, one predominates. The cause of these currents seems to lie in contractions of the protoplasm which bounds the channels in which they flow, but which are so minute that the best microscopes show only their effects, and not themselves.

The spectacle afforded by the wonderful energies prisoned within the compass of the microscopic hair of a plant, which we commonly regard as a merely passive organism, is not easily forgotten by one who has watched its display, continued hour after hour, without pause or sign of weakening. The possible complexity of many other organic forms, seemingly as simple as the protoplasm of the nettle, dawns upon one; and the comparison of such a protoplasm to a body with an internal circulation, which has been put forward by an eminent physiologist, loses much of its startling character. Currents similar to those of the hairs of the nettle have been observed in a great multitude of very different plants, and weighty authorities have suggested that they probably occur, in more or less perfection, in all young vegetable cells. If such be the case, the wonderful noonday silence of a tropical forest is, after all, due only to the dulness of our hearing; and could our ears catch the murmur of these tiny Maelstroms, as they whirl in the innumerable myriads of living cells which constitute each tree, we should be stunned, as with the roar of a great city.

Among the lower plants, it is the rule rather than the exception, that contractility should be still more openly manifested at some periods of their existence. The protoplasm of *Algæ* and *Fungi* becomes, under many circumstances, partially, or completely, freed from its woody case, and exhibits movements of its whole mass, or is propelled by the contractility of one, or more, hair-like prolongations of its body, which are called vibratile cilia. And, so far as the conditions of the manifestation of the phenomena of contractility have yet been studied, they are the same for the plant as for the animal. Heat and electric shocks influence both, and in the same way, though it may be in different degrees. It is by no means my intention to suggest that there is no difference in faculty between the lowest plant and the highest, or between plants and animals. But the difference between the powers of the lowest plant, or animal, and those of the highest is one of degree, not of kind, and depends, as Milne-Edwards long ago so well pointed out, upon the extent to which the principle of the division of labour is carried out in the living economy. In the lowest organism all parts are competent to perform all functions, and one and the same portion of protoplasm may successively take on the

function of feeding, moving, or reproducing apparatus. In the highest, on the contrary, a great number of parts combine to perform each function, each part doing its allotted share of the work with great accuracy and efficiency, but being useless for any other purpose.

On the other hand, notwithstanding all the fundamental resemblances which exist between the powers of the protoplasm in plants and in animals, they present a striking difference (to which I shall advert more at length presently), in the fact that plants can manufacture fresh protoplasm out of mineral compounds, whereas animals are obliged to procure it ready made, and hence, in the long run, depend upon plants. Upon what condition this difference in the powers of the two great divisions of the world of life depends nothing is at present known.

With such qualification as arises out of the last-mentioned fact, it may be truly said that the acts of all living things are fundamentally one. Is any such unity predicable of their forms? Let us seek in easily verified facts for a reply to this question. If a drop of blood be drawn by pricking one's finger, and viewed with proper precautions and under a sufficiently high microscopic power, there will be seen, among the innumerable multitude of little, circular, discoidal bodies, or corpuscles, which float in it and give it its colour, a comparatively small number of colourless corpuscles, of somewhat larger size and very irregular shape. If the drop of blood be kept at the temperature of the body, these colourless corpuscles will be seen to exhibit a marvellous activity, changing their forms with great rapidity, drawing in and thrusting out prolongations of their substance, and creeping about as if they were independent organisms.

The substance which is thus active is a mass of protoplasm, and its activity differs in detail, rather than in principle, from that of the protoplasm of the nettle. Under sundry circumstances the corpuscle dies and becomes distended into a round mass, in the midst of which is seen a smaller spherical body, which existed, but was more or less hidden, in the living corpuscle, and is called its *nucleus*. Corpuscles of essentially similar structure are to be found in the skin, in the lining of the mouth, and scattered through the whole framework of the body. Nay, more; in the earliest condition of the human organism, in that state in which it has but just become distinguishable from the egg in which it arises, it is nothing but an aggregation of such corpuscles, and every organ of the body was, once, no more than such an aggregation.

Thus a nucleated mass of protoplasm turns out to be what may be termed the structural unit of the human body. As a matter of fact, the body, in its earliest state, is a mere multiple of such units; and, in its perfect condition, it is a multiple of such units, variously modified.

But does the formula which expresses the essential structural character of the highest animal cover all the rest, as the statement

of its powers and faculties covered that of all others? Very nearly. Beast and fowl, reptile and fish, mollusk, worm, and polype, are all composed of structural units of the same character, namely, masses of protoplasm with a nucleus. There are sundry very low animals, each of which, structurally, is a mere colourless blood-corpuscle, leading an independent life. But, at the very bottom of the animal scale, even this simplicity becomes simplified, and all the phenomena of life are manifested by a particle of protoplasm without a nucleus. Nor are such organisms insignificant by reason of their want of complexity. It is a fair question whether the protoplasm of those simplest forms of life, which people an immense extent of the bottom of the sea, would not outweigh that of all the higher living beings which inhabit the land put together. And in ancient times, no less than at the present day, such living beings as these have been the greatest of rock builders.

What has been said of the animal world is no less true of plants. Imbedded in the protoplasm at the broad, or attached, end of the nettle hair, there lies a spheroidal nucleus. Careful examination further proves that the whole substance of the nettle is made up of a repetition of such masses of nucleated protoplasm, each contained in a wooden case, which is modified in form, sometimes into a woody fibre, sometimes into a duct or spiral vessel, sometimes into a pollen grain, or an ovule. Traced back to its earliest state, the nettle arises as the man does, in a particle of nucleated protoplasm. And in the lowest plants, as in the lowest animals, a single mass of such protoplasm may constitute the whole plant, or the protoplasm may exist without a nucleus.

Under these circumstances it may well be asked, how is one mass of non-nucleated protoplasm to be distinguished from another? why call one "plant" and the other "animal"?

The only reply is that, so far as form is concerned, plants and animals are not separable, and that, in many cases, it is a mere matter of convention whether we call a given organism an animal or a plant. There is a living body called *Æthalium septicum*, which appears upon decaying vegetable substances, and in one of its forms, is common upon the surfaces of tan pits. In this condition it is, to all intents and purposes, a fungus, and formerly was always regarded as such; but the remarkable investigations of De Bary have shown that, in another condition, the *Æthalium* is an actively locomotive creature, and takes in solid matters, upon which, apparently, it feeds, thus exhibiting the most characteristic feature of animality. Is this a plant; or is it an animal? Is it both; or is it neither? Some decide in favour of the last supposition, and establish an intermediate kingdom, a sort of biological No Man's Land for all these questionable forms. But, as it is admittedly impossible to draw any distinct boundary line between this no man's land and the vegetable world on the one hand,

or the animal, on the other, it appears to me that this proceeding merely doubles the difficulty which, before, was single.

Protoplasm, simple or nucleated, is the formal basis of all life. It is the clay of the potter: which, bake it and paint it as he will, remains clay, separated by artifice, and not by nature, from the commonest brick or sun-dried clod.

Thus it becomes clear that all living powers are cognate, and that all living forms are fundamentally of one character. The researches of the chemist have revealed a no less striking uniformity of material composition in living matter.

In perfect strictness, it is true that chemical investigation can tell us little or nothing, directly, of the composition of living matter, inasmuch as such matter must needs die in the act of analysis,—and upon this very obvious ground, objections, which I confess seem to me to be somewhat frivolous, have been raised to the drawing of any conclusions whatever respecting the composition of actually living matter, from that of the dead matter of life, which alone is accessible to us. But objectors of this class do not seem to reflect that it is also, in strictness, true that we know nothing about the composition of any body whatever, as it is. The statement that a crystal of calc-spar consists of carbonate of lime, is quite true, if we only mean that, by appropriate processes, it may be resolved into carbonic acid and quicklime. If you pass the same carbonic acid over the very quicklime thus obtained, you will obtain carbonate of lime again; but it will not be calc-spar, nor anything like it. Can it, therefore, be said that chemical analysis teaches nothing about the chemical composition of calc-spar? Such a statement would be absurd; but it is hardly more so than the talk one occasionally hears about the uselessness of applying the results of chemical analysis to the living bodies which have yielded them.

One fact, at any rate, is out of reach of such refinements, and this is, that all the forms of protoplasm which have yet been examined contain the four elements, carbon, hydrogen, oxygen, and nitrogen, in very complex union, and that they behave similarly towards several reagents. To this complex combination, the nature of which has never been determined with exactness, the name of Protein has been applied. And if we use this term with such caution as may properly arise out of our comparative ignorance of the things for which it stands, it may be truly said, that all protoplasm is proteinaceous; or, as the white, or albumen, of an egg is one of the commonest examples of a nearly pure proteine matter, we may say that all living matter is more or less albuminoid.

Perhaps it would not yet be safe to say that all forms of protoplasm are affected by the direct action of electric shocks; and yet the number of cases in which the contraction of protoplasm is shewn to be effected by this agency increases every day.

Nor can it be affirmed with perfect confidence, that all forms of protoplasm are liable to undergo that peculiar coagulation at a temperature of 40°—50° centigrade, which has been called "heat-stiffening," though Kühne's beautiful researches have proved this occurrence to take place in so many and such diverse living beings, that it is hardly rash to expect that the law holds good for all.

Enough has, perhaps, been said to prove the existence of a general uniformity in the character of the protoplasm, or physical basis, of life, in whatever group of living beings it may be studied. But it will be understood that this general uniformity by no means excludes any amount of special modifications of the fundamental substance. The mineral, carbonate of lime, assumes an immense diversity of characters, though no one doubts that under all these Protean changes it is one and the same thing.

And now, what is the ultimate fate, and what the origin, of the matter of life?

Is it, as some of the older naturalists supposed, diffused throughout the universe in molecules, which are indestructible and unchangeable in themselves; but, in endless transmigration, unite in innumerable permutations, into the diversified forms of life we know? Or, is the matter of life composed of ordinary matter, differing from it only in the manner in which its atoms are aggregated. Is it built up of ordinary matter, and again resolved into ordinary matter when its work is done?

Modern science does not hesitate a moment between these alternatives. Physiology writes over the portals of life—

"Debemur morti nos nostraque,"

with a profounder meaning than the Roman poet attached to that melancholy line. Under whatever disguise it takes refuge, whether fungus or oak, worm or man, the living protoplasm not only ultimately dies and is resolved into its mineral and lifeless constituents, but is always dying, and, strange as the paradox may sound, could not live unless it died.

In the wonderful story of the "Peau de Chagrin," the hero becomes possessed of a magical wild ass' skin, which yields him the means of gratifying all his wishes. But its surface represents the duration of the proprietor's life; and for every satisfied desire the skin shrinks in proportion to the intensity of fruition, until at length life and the last handbreadth of the *peau de chagrin* disappear with the gratification of a last wish.

Balzac's studies had led him over a wide range of thought and speculation, and his shadowing forth of physiological truth in this strange story may have been intentional. At any rate, the matter of life is a veritable *peau de chagrin*, and for every vital act it

is somewhat the smaller. All work implies waste, and the work of life results, directly or indirectly, in the waste of protoplasm.

Every word uttered by a speaker costs him some physical loss; and, in the strictest sense, he burns that others may have light—so much eloquence, so much of his body resolved into carbonic acid, water, and urea. It is clear that this process of expenditure cannot go on for ever. But, happily, the protoplasmic *peau de chagrin* differs from Balzac's in its capacity of being repaired, and brought back to its full size, after every exertion.

For example, this present lecture, whatever its intellectual worth to you, has a certain physical value to me, which is, conceivably, expressible by the number of grains of protoplasm and other bodily substance wasted in maintaining my vital processes during its delivery. My *peau de chagrin* will be distinctly smaller at the end of the discourse than it was at the beginning. By-and-by, I shall probably have recourse to the substance commonly called mutton, for the purpose of stretching it back to its original size. Now this mutton was once the living protoplasm, more or less modified, of another animal —a sheep. As I shall eat it, it is the same matter altered, not only by death, but by exposure to sundry artificial operations in the process of cooking.

But these changes, whatever be their extent, have not rendered it incompetent to resume its old functions as matter of life. A singular inward laboratory, which I possess, will dissolve a certain portion of the modified protoplasm, the solution so formed will pass into my veins; and the subtle influences to which it will then be subjected will convert the dead protoplasm into living protoplasm, and transubstantiate sheep into man.

Nor is this all. If digestion were a thing to be trifled with, I might sup upon lobster, and the matter of life of the crustacean would undergo the same wonderful metamorphosis into humanity. And were I to return to my own place by sea, and undergo shipwreck, the crustacea might, and probably would, return the compliment, and demonstrate our common nature by turning my protoplasm into living lobster. Or, if nothing better were to be had, I might supply my wants with mere bread, and I should find the protoplasm of the wheat-plant to be convertible into man, with no more trouble than that of the sheep, and with far less, I fancy, than that of the lobster.

Hence it appears to be a matter of no great moment what animal, or what plant, I lay under contribution for protoplasm, and the fact speaks volumes for the general identity of that substance in all living beings. I share this catholicity of assimilation with other animals, all of which, so far as we know, could thrive equally well on the protoplasm of any of their fellows, or of any plant; but here the assimilative powers of the animal world cease. A solution of smelling-salts in water, with an infinitesimal proportion of some

other saline matters, contains all the elementary bodies which enter into the composition of protoplasm; but, as I need hardly say, a hogshead of that fluid would not keep a hungry man from starving, nor would it save any animal whatever from a like fate. An animal cannot make protoplasm, but must take it ready-made from some other animal, or some plant—the animal's highest feat of constructive chemistry being to convert dead protoplasm into that living matter of life which is appropriate to itself.

Therefore, in seeking for the origin of protoplasm, we must eventually turn to the vegetable world. The fluid containing carbonic acid, water, and ammonia, which offers such a Barmecide feast to the animal, is a table richly spread to multitudes of plants; and, with a due supply of only such materials, many a plant will not only maintain itself in vigour, but grow and multiply until it has increased a million-fold, or a million million-fold, the quantity of protoplasm which it originally possessed; in this way building up the matter of life, to an indefinite extent, from the common matter of the universe.

Thus, the animal can only raise the complex substance of dead protoplasm to the higher power, as one may say, of living protoplasm; while the plant can raise the less complex substances—carbonic acid, water, and ammonia—to the same stage of living protoplasm, if not to the same level. But the plant also has its limitations. Some of the fungi, for example, appear to need higher compounds to start with; and no known plant can live upon the uncompounded elements of protoplasm. A plant supplied with pure carbon, hydrogen, oxygen, and nitrogen, phosphorus, sulphur, and the like, would as infallibly die as the animal in his bath of smelling-salts, though it would be surrounded by all the constituents of protoplasm. Nor, indeed, need the process of simplification of vegetable food be carried so far as this, in order to arrive at the limit of the plant's thaumaturgy. Let water, carbonic acid, and all the other needful constituents be supplied without ammonia, and an ordinary plant will still be unable to manufacture protoplasm.

Thus the matter of life, so far as we know it (and we have no right to speculate on any other), breaks up, in consequence of that continual death which is the condition of its manifesting vitality, into carbonic acid, water, and ammonia, which certainly possess no properties but those of ordinary matter. And out of these same forms of ordinary matter, and from none which are simpler, the vegetable world builds up all the protoplasm which keeps the animal world agoing. Plants are the accumulators of the power which animals distribute and disperse.

But it will be observed, that the existence of the matter of life depends on the pre-existence of certain compounds, namely, carbonic acid, water, and ammonia. Withdraw any one of these three from the world and all vital phenomena come to an end. They are related

to the protoplasm of the plant, as the protoplasm of the plant is to that of the animal. Carbon, hydrogen, oxygen, and nitrogen are all lifeless bodies. Of these, carbon and oxygen unite in certain proportions and under certain conditions, to give rise to carbonic acid; hydrogen and oxygen produce water; nitrogen and hydrogen give rise to ammonia. These new compounds, like the elementary bodies of which they are composed, are lifeless. But when they are brought together, under certain conditions they give rise to the still more complex body, protoplasm, and this protoplasm exhibits the phenomena of life.

I see no break in this series of steps in molecular complication, and I am unable to understand why the language which is applicable to any one term of the series may not be used to any of the others. We think fit to call different kinds of matter carbon, oxygen, hydrogen, and nitrogen, and to speak of the various powers and activities of these substances as the properties of the matter of which they are composed.

When hydrogen and oxygen are mixed in a certain proportion, and an electric spark is passed through them, they disappear, and a quantity of water, equal in weight to the sum of their weights, appears in their place. There is not the slightest parity between the passive and active powers of the water and those of the oxygen and hydrogen which have given rise to it. At 32° Fahrenheit, and far below that temperature, oxygen and hydrogen are elastic gaseous bodies, whose particles tend to rush away from one another with great force. Water, at the same temperature, is a strong though brittle solid, whose particles tend to cohere into definite geometrical shapes, and sometimes build up frosty imitations of the most complex forms of vegetable foliage.

Nevertheless we call these, and many other strange phenomena, the properties of the water, and we do not hesitate to believe that, in some way or another, they result from the properties of the component elements of the water. We do not assume that a something called "aquosity" entered into and took possession of the oxide of hydrogen as soon as it was formed, and then guided the aqueous particles to their places in the facets of the crystal, or amongst the leaflets of the hoar-frost. On the contrary, we live in the hope and in the faith that, by the advance of molecular physics, we shall by-and-by be able to see our way as clearly from the constituents of water to the properties of water, as we are now able to deduce the operations of a watch from the form of its parts and the manner in which they are put together.

Is the case in any way changed when carbonic acid, water, and ammonia disappear, and in their place, under the influence of pre-existing living protoplasm, an equivalent weight of the matter of life makes its appearance?

It is true that there is no sort of parity between the properties of the components and the properties of the resultant, but neither was there in the case of the water. It is also true that what I have spoken of as the influence of pre-existing living matter is something quite unintelligible; but does anybody quite comprehend the *modus operandi* of an electric spark, which traverses a mixture of oxygen and hydrogen?

What justification is there, then, for the assumption of the existence in the living matter of a something which has no representative or correlative in the not living matter which gave rise to it? What better philosophical status has "vitality" than "aquosity?" And why should "vitality" hope for a better fate than the other "itys" which have disappeared since Martinus Scriblerus accounted for the operation of the meat-jack by its inherent "meat roasting quality," and scorned the "materialism" of those who explained the turning of the spit by a certain mechanism worked by the draught of the chimney?

If scientific language is to possess a definite and constant signification whenever it is employed, it seems to me that we are logically bound to apply to the protoplasm, or physical basis of life, the same conceptions as those which are held to be legitimate elsewhere. If the phenomena exhibited by water are its properties, so are those presented by protoplasm, living or dead, its properties.

If the properties of water may be properly said to result from the nature and disposition of its component molecules, I can find no intelligible ground for refusing to say that the properties of protoplasm result from the nature and disposition of its molecules.

But I bid you beware that, in accepting these conclusions, you are placing your feet on the first rung of a ladder which, in most people's estimation, is the reverse of Jacob's, and leads to the antipodes of heaven. It may seem a small thing to admit that the dull vital actions of a fungus, or a foraminifer, are the properties of their protoplasm, and are the direct results of the nature of the matter of which they are composed. But if, as I have endeavoured to prove to you, their protoplasm is essentially identical with, and most readily converted into, that of any animal, I can discover no logical halting-place between the admission that such is the case, and the further concession that all vital action may, with equal propriety, be said to be the result of the molecular forces of the protoplasm which displays it. And if so, it must be true, in the same sense and to the same extent, that the thoughts to which I am now giving utterance, and your thoughts regarding them, are the expression of molecular changes in that matter of life which is the source of our other vital phenomena.

Past experience leads me to be tolerably certain that, when the

propositions I have just placed before you are accessible to public comment and criticism, they will be condemned by many zealous persons, and perhaps by some few of the wise and thoughtful. I should not wonder if "gross and brutal materialism" were the mildest phrase applied to them in certain quarters. And most undoubtedly the terms of the propositions are distinctly materialistic. Nevertheless two things are certain: the one, that I hold the statements to be substantially true; the other, that I, individually, am no materialist, but, on the contrary, believe materialism to involve grave philosophical error.

This union of materialistic terminology with the repudiation of materialistic philosophy, I share with some of the most thoughtful men with whom I am acquainted. And, when I first undertook to deliver the present discourse, it appeared to me to be a fitting opportunity to explain how such an union is not only consistent with, but necessitated by, sound logic. I purposed to lead you through the territory of vital phenomena to the materialistic slough in which you find yourselves now plunged, and then to point out to you the sole path by which, in my judgment, extrication is possible.

An occurrence of which I was unaware until my arrival here last night, renders this line of argument singularly opportune. I found in your papers the eloquent address "On the Limits of Philosophical Inquiry," which a distinguished prelate of the English Church delivered before the members of the Philosophical Institution on the previous day. My argument, also, turns upon this very point of limits of philosophical inquiry; and I cannot bring out my own views better than by contrasting them with those so plainly, and, in the main, fairly, stated by the Archbishop of York.

But I may be permitted to make a preliminary comment upon an occurrence that greatly astonished me. Applying the name of "the New Philosophy" to that estimate of the limits of philosophical inquiry which I, in common with many other men of science, hold to be just, the Archbishop opens his address by identifying this "New Philosophy" with the Positive Philosophy of M. Comte (of whom he speaks as its "founder"); and then proceeds to attack that philosopher and his doctrines vigorously.

Now, so far as I am concerned, the most reverend prelate might dialectically hew M. Comte in pieces, as a modern Agag, and I should not attempt to stay his hand. In so far as my study of what specially characterises the Positive Philosophy has led me, I find therein little or nothing of any scientific value, and a great deal, which is as thoroughly antagonistic to the very essence of science as anything in ultramontane Catholicism. In fact, M. Comte's philosophy in practice might be compendiously described as Catholicism *minus* Christianity.

But what has Comtism to do with the "New Philosophy," as the Archbishop defines it in the following passage?—

"Let me briefly remind you of the leading principles of this new philosophy. "All knowledge is experience of facts acquired by the senses. The traditions of older philosophies have obscured our experience by mixing with it much that the senses cannot observe, and until these additions are discarded our knowledge is impure. Thus metaphysics tell us that one fact which we observe is a cause, and another is the effect of that cause; but upon a rigid analysis, we find that our senses observe nothing of cause or effect: they observe, first, that one fact succeeds another, and, after some opportunity, that this fact has never failed to follow—that for cause and effect we should substitute invariable succession. An older philosophy teaches us to define an object by distinguishing its essential from its accidental qualities: but experience knows nothing of essential and accidental; she sees only that certain marks attach to an object, and, after many observations, that some of them attach invariably, whilst others may at times be absent. . . . . As all knowledge is relative, the notion of anything being necessary must be banished with other traditions."[1]

There is much here that expresses the spirit of the "New Philosophy," if by that term be meant the spirit of modern science; but I cannot but marvel that the assembled wisdom and learning of Edinburgh should have uttered no sign of dissent, when Comte was declared to be the founder of these doctrines. No one will accuse Scotchmen of habitually forgetting their great countrymen; but it was enough to make David Hume turn in his grave, that here, almost within ear-shot of his house, an instructed audience should have listened, without a murmur, while his most characteristic doctrines were attributed to a French writer of fifty years later date, in whose dreary and verbose pages we miss alike the vigour of thought and the exquisite clearness of style of the man whom I make bold to term the most acute thinker of the eighteenth century—even though that century produced Kant.

But I did not come to Scotland to vindicate the honour of one of the greatest men she has ever produced. My business is to point out to you that the only way of escape out of the crass materialism in which we just now landed is the adoption and strict working-out of the very principles which the Archbishop holds up to reprobation.

Let us suppose that knowledge is absolute, and not relative, and therefore, that our conception of matter represents that which it really is. Let us suppose, further, that we do know more of cause and effect than a certain definite order of succession among facts, and that we have a knowledge of the necessity of that succession—and hence, of necessary laws—and I, for my part, do not see what escape there is from utter materialism and necessarianism. For it is obvious that our knowledge of what we call the material world is, to begin with, at least as certain and definite as that of the spiritual world, and that our acquaintance with law is of as old a date as our knowledge of spontaneity. Further, I take it to be demonstrable that it is utterly impossible to prove that anything

(1) "The Limits of Philosophical Inquiry," pp. 4 and 5.

whatever may not be the effect of a material and necessary cause, and that human logic is equally incompetent to prove that any act is really spontaneous. A really spontaneous act is one which, by the assumption, has no cause; and the attempt to prove such a negative as this is, on the face of the matter, absurd. And while it is thus a philosophical impossibility to demonstrate that any given phenomenon is not the effect of a material cause, any one who is acquainted with the history of science will admit, that its progress has, in all ages, meant, and now, more than ever, means, the extension of the province of what we call matter and causation, and the concomitant gradual banishment from all regions of human thought of what we call spirit and spontaneity.

I have endeavoured, in the first part of this discourse, to give you a conception of the direction towards which modern physiology is tending; and I ask you, what is the difference between the conception of life as the product of a certain disposition of material molecules, and the old notion of an Archæus governing and directing blind matter within each living body, except this—that here, as elsewhere, matter and law have devoured spirit and spontaneity? And as surely as every future grows out of past and present, so will the physiology of the future gradually extend the realm of matter and law until it is co-extensive with knowledge, with feeling, and with action.

The consciousness of this great truth weighs like a nightmare, I believe, upon many of the best minds of these days. They watch what they conceive to be the progress of materialism, in such fear and powerless anger as a savage feels, when, during an eclipse, the great shadow creeps over the face of the sun. The advancing tide of matter threatens to drown their souls; the tightening grasp of law impedes their freedom; they are alarmed lest man's moral nature be debased by the increase of his wisdom.

If the "New Philosophy" be worthy of the reprobation with which it is visited, I confess their fears seem to me, to be well founded. While, on the contrary, could David Hume be consulted, I think he would smile at their perplexities, and chide them for doing even as the heathen, and falling down in terror before the hideous idols their own hands have raised.

For, after all, what do we know of this terrible "matter," except as a name for the unknown and hypothetical cause of states of our own consciousness? And what do we know of that "spirit" over whose threatened extinction by matter a great lamentation is arising, like that which was heard at the death of Pan, except that it is also a name for an unknown and hypothetical cause, or condition, of states of consciousness? In other words, matter and spirit are but names for the imaginary substrata of groups of natural phenomena.

And what is the dire necessity and "iron" law under which men groan? Truly, most gratuitously invented bugbears. I suppose if there be an "iron" law, it is that of gravitation; and if there be a

physical necessity, it is that a stone, unsupported, must fall to the ground. But what is all we really know and can know about the latter phenomenon? Simply, that, in all human experience, stones have fallen to the ground under these conditions; that we have not the smallest reason for believing that any stone so circumstanced will not fall to the ground; and that we have, on the contrary, every reason to believe that it will so fall. It is very convenient to indicate that all the conditions of belief have been fulfilled in this case, by calling the statement that unsupported stones will fall to the ground, "a law of nature." But when, as commonly happens, we change *will* into *must*, we introduce an idea of necessity which most assuredly does not lie in the observed facts, and has no warranty that I can discover elsewhere. For my part, I utterly repudiate and anathematise the intruder. Fact I know; and Law I know; but what is this Necessity, save an empty shadow of my own mind's throwing?

But, if it is certain that we can have no knowledge of the nature of either matter or spirit, and that the notion of necessity is something illegitimately thrust into the perfectly legitimate conception of law, the materialistic position that there is nothing in the world but matter, force, and necessity, is as utterly devoid of justification as the most baseless of theological dogmas. The fundamental doctrines of materialism, like those of spiritualism, and most other "isms," lie outside "the limits of philosophical inquiry," and David Hume's great service to humanity is his irrefragable demonstration of what these limits are. Hume called himself a sceptic, and therefore others cannot be blamed if they apply the same title to him; but that does not alter the fact that the name, with its existing implications, does him gross injustice.

If a man asks me what the politics of the inhabitants of the moon are, and I reply that I do not know; that neither I, nor any one else, have any means of knowing; and that, under these circumstances, I decline to trouble myself about the subject at all, I do not think he has any right to call me a sceptic. On the contrary, in replying thus, I conceive that I am simply honest and truthful, and show a proper regard for the economy of time. So Hume's strong and subtle intellect takes up a great many problems about which we are naturally curious, and shows us that they are essentially questions of lunar politics, in their essence incapable of being answered, and therefore not worth the attention of men who have work to do in the world. And he thus ends one of his essays:—

"If we take in hand any volume of Divinity, or school metaphysics, for instance, let us ask, *Does it contain any abstract reasoning concerning quantity or number?* No. *Does it contain any experimental reasoning concerning matter of fact and existence?* No. Commit it then to the flames; for it can contain nothing but sophistry and illusion." [1]

(1) Hume's Essay "Of the Academical or Sceptical Philosophy," in the "Inquiry Concerning the Human Understanding."

Permit me to enforce this most wise advice. Why trouble ourselves about matters of which, however important they may be, we do know nothing, and can know nothing? We live in a world which is full of misery and ignorance, and the plain duty of each and all of us is to try to make the little corner he can influence somewhat less miserable and somewhat less ignorant than it was before he entered it. To do this effectually it is necessary to be fully possessed of only two beliefs: the first that the order of nature is ascertainable by our faculties to an extent which is practically unlimited; the second, that our volition counts for something as a condition of the course of events.

Each of these beliefs can be verified experimentally, as often as we like to try. Each, therefore, stands upon the strongest foundation upon which any belief can rest; and forms one of our highest truths. If we find that the ascertainment of the order of nature is facilitated by using one terminology, or one set of symbols, rather than another, it is our clear duty to use the former; and no harm can accrue, so long as we bear in mind, that we are dealing merely with terms and symbols.

In itself it is of little moment whether we express the phenomena of matter in terms of spirit; or the phenomena of spirit, in terms of matter; matter may be regarded as a form of thought, thought may be regarded as a property of matter—each statement has a certain relative truth. But with a view to the progress of science, the materialistic terminology is in every way to be preferred. For it connects thought with the other phenomena of the universe, and suggests inquiry into the nature of those physical conditions, or concomitants of thought, which are more or less accessible to us, and a knowledge of which may, in future, help us to exercise the same kind of control over the world of thought, as we already possess in respect of the material world; whereas, the alternative, or spiritualistic, terminology is utterly barren, and leads to nothing but obscurity and confusion of ideas.

Thus there can be little doubt that the further science advances the more extensively and consistently will all the phenomena of nature be represented by materialistic formulæ and symbols.

But the man of science, who, forgetting the limits of philosophical inquiry, slides from these formulæ and symbols into what is commonly understood by materialism, seems to me to place himself on a level with the mathematician, who should mistake the x's and y's, with which he works his problems, for real entities—and with this further disadvantage, as compared with the mathematician, that the blunders of the latter are of no practical consequence, while the errors of systematic materialism may paralyse the energies and destroy the beauty of a life.

T. H. Huxley.

THE PRODIGAL.

I.

A GIRLISH mother at eventide
  Sat watching by her child;
The foolishest nursing rhymes she sang;
  She sighed, and then she smiled.

A double string of small clear pearls
  Passed round and round her head,
And thence her ample flaxen hair
  Was down her straight back shed.

She smoothed the counterpane, she kissed
  Its face with a serious joy,
And there was peace in the mother's heart
  Over her sleeping boy.

"My little son," she thought, "the weeks
  Fly quickly past with thee,
For love and hope sit by my side,
  And often talk to me.

"My little son, the time will come
  Thou wilt be strong and swift,
And I grown old and weak, employed
  In almous deeds and shrift.

"My little son, when that time comes
  Thou sure wilt be my stay,
As now it is my happiness
  To watch thee day by day."

She trailed her long hair o'er his face,
  She merrily clapped her hands:
He wakes; around her bended neck
  His short round arm expands.

The child hath grown into a youth,
With a poignard by his waist:
No battle blade, but fair to see,
In spangled velvet cased.

Often he tries its eager edge,
And fondles its hilt with pride:
Anon another bauble gay
Is added to its side,
A bugle horn with golden tip
That he might hunting ride.

But he forgot them both full soon,
And dropp'd them with a sneer;
His mother strove with wondering love
His wilfulness to cheer:
"Lady," said he, "it suits not me
To be thus cabin'd here.

"It may be well for such as till,
To live upon the ground,
But none have I to talk unto
Except my otter hound."

He left the old tower and its hills,
And when they were gone from sight,
The smile came back upon his lip,
His eye again grew bright.

Years are as yesterdays: a barque
Up the Ebro glided fast,
And from the deck a stout gallant
Impatient glances cast.

A dark short man full richly clad,
With hair on his pointed chin,
His eyebrow back to his temple slants,
And his well-shaped cheek is thin,
Three letters in his hand held he,
And thus he scanned them hastily.

"This from a fool who wears his cap,
Like a doctor's hat awry,
Advising me, he is so wise
In his cloistered privacy!

"This from one belted in the field,
To wile me to his side;
But I have pleasanter cards in hand
Than either of those men guide.

"And these! in sooth these are the lines
A mother can only trace;
I've ta'en the last coin out of the chest,
The last smile from her face.
What help is there? I should have heir'd
As fits my name and race!"

He rent the leaves, and with both hands
Scattered them o'er the rail;
"Now I return at last," quoth he,
"And quick enough we sail."

Along these rails an awning swung
Striped all with pink and green,
And as he stoops beneath it, we
May enter too, I ween.

For there two dames whose dimpled cheeks
Are very rosy, greet
The enterer, and they gaily throw
Flower heads about his feet.

The ivory and the silver cup,
The sweet wine and the strong,
The light breeze winnowing the warm air,
The jape and jest and song!
For land or coin, for name or power
He would not barter that one hour.

She sits within the dark cold room;
On the arras old and dun,
Lady Diana's round face shines;
Her hounds all leap and run.

But now they lack the cheer that once
They gave to that widow's eye;
There is no mirth in that crowded haste,
No light upon the sky.

The little boy she sang to sleep
Since then hath been long away,
And forgotten her quite in his trafficking
With maskers night and day.

She hath hoped and feared and hoped again,
  She hath wiped the sore tear oft,
Prayers hath she sent up to the saints,
  So far away aloft.

"Lady! the count's esquire doth wait
  With a message brought to thee,
And with him, on two palfreys white,
  Two ladies from over the sea.

"The count doth follow soon"—she sank,
  O'ercome by this dear joy;
She would have thanked her guardian Saint:
  But a squire—two ladies with her boy—
She gasped as she would faint.

II.

Reach me the tapers for the head,
  The tapers for the feet—
Three for each; now fetch the salt,
  To dress the corpse complete.

Strip ye the arras from the wall,
  Darken the window quite,
That the sheer moonshine look not in,
  Nor any of God's light.

So, so, the floor is well rush-strewn,
  To soften every sound;
Bid the warder slip the hours to-night,
  Keep still the old sleuth-hound.

Thus was the long white body laid,
  With the chaplet on the breast,—
The breast that in song-singing years
  Had been the baby's nest.

A cross was laid upon the flowers;
  Some wandering silver hair
Gleamed by the edge of the close round cap
  On the cheek so sadly fair.

The dear face I shall not describe,
For that I might have blame;
The swathing white was edged with black,
Upon a bier the same.

The seneschal sat in the buttery,
By his chair stood his serving-loon;
The seneschal's fingers on the board
Kept beating a senseless tune.

"Sancho," said he, as he looked about,
"Sancho," said he again,
"Our master's is no common deed,
That common shrift may sain.

"He may give gold, if gold remains;
They may say the weird is past;
But the doom from this household, I ween,
Nevermore can be cast.

"I stay within this moated wall
No longer than the nine;
And—for he owes me twenty marks—
These flagons shall be mine.

"Wilt thou go with me to the town,
Sancho, to be my groom?"
Quoth Sancho, "I will go with thee:
He's mad, and I'm afraid lest he
May punish me in your room!"

"Open the wicket!" "Where go ye?"
"It matters not: away."
"Leave us the keys of the buttery,
And come back when ye may!"

The twain went forth at eventide,
So the watchman left the wall;
"The master's mad," said he, and called
The lacqueys from the hall:
One hour thereafter not a man
Was sober of them all.

"What can the young count's errand be;
I fear the stripling not!
Though he hath taxed the convent rents,"
Quoth the abbot, with husky throat.

The young knight entered: like the man
Who waits for another's blood,
He slid into the dusky room;
With quivering lips he stood

And whispered, "It is thy turn now;"
Then down on his knees he sank,
And to the padre stretched his hands,
Who back in his high chair shrank.

"'Tis thy turn now, Sir Abbot, and here,
For help I come to thee."
"Whate'er thy shrift, young sir, I am
Glad thou hast come to me."

With that, the silver whistle seized
The old man, white with dread;
But by his feet, upon the hearth,
Sank down the youngling's head.

The serving-men keep up their game,
Not one yet wipes his lips;
The tankards rattle, and the wine
From the board's edges drips.

A room there was above that hall;
The two fair dames sat there:
One had been weeping, and she sat
Sobbing, with idle stare.

The other, with two long black curls
Was imping out her head,
Knitting them to her own short hair
With great beads, green and red.

In the left corner of this room
Two other 'live things sat,—
Two of a different kith! a race
Long-toothed, and lean, and flat!

Their long loose-jointed legs, like flails,
Were folded back straightway;
Each motion of the two fair dames
Still counterfeited they.

"Is all aright?" asked one, and turned
His amber-coloured eyes
On his ungainly brother, who sat,
Bent forward, listeningwise.

"Is all aright?" "It is, it is;
He gives the abbot gold!"
Their sharp jaws opened and closed thrice,
Laughing at what was sold.

"What doth he say?" "He hath not yet
Trusted the father's ear
With words he would not once repeat—
How the abbot longs to hear!"

"I think it wears not yet too late,"
Said the lady with imped hair;
"He will return." Quoth the mocking fiend,
"That will he not, my fair!"

"It was no crime that I can see,
To tell him her foul speech;
'Twas her own hand that did the scathe;
Who dares the Count impeach?"

"Ho, ho! the abbot knows all now,"
The listening creature cried,
"And avers such wickedness as that
His Master can't abide!

"The count will have his money again!"
The fiend threw out his hand,
As if he were in the very cell
Where the youth and the father stand.

"The abbot will not let it go;
He charges him to hide
I' the sanctuary of Peter and Paul,
Ere twelve o' the clock betide.

"Midnight! 'tis many leagues from hence,
And now the moon is high;
We have no power within that bower,
But we'll have him though he fly!"

Up started the black-haired dame in haste:
"Did some one pass me now?
Or was it but the gusty wind
That ran across my brow?"

III.

"Thirty stark miles, a hasty ride
Ere the midnight bell I hear;
To my stout Barbery I trust,
God wot I never fear."

A few steps left the paven street,
Or his race might well begin,
His mouth was black, and his brow was white,
A red spot was on his chin.

The moon hath drawn a watery swathe
Before her ghostly eye;
Darkling over the heath you'll see
His feather against the sky.

"It matters not to me," thinks he,
"We do not need her light;"
But the rowel sank in his horse's flank,
Till it leaped five feet in height.

"They hope I will not gain the place!"
He dashed them in again;
"But never I rode without winning the race!"
And on he sped amain.

The clouds that, as he mounted, strayed
Like a white flock of sheep,
Have rolled together on his path,
Moaning, and mirk, and deep.

The blast bursts from them, by the clasp
His bonnet flies behind,
In the nostrils of his Kochlan mare
Whistles the stifling wind.

He curses the storm, but down his throat
The words are thrust again;
His bloody spurs are useless now,
His eyes are shut by the rain.

Cries the Bridge-warder, peering out
From his solar, "Ben'cité!
To swim the swollen stream to-night
A madman must he be!

"God, have mercy on the man,
The gate is wide, the bridge is clear!"
But he plunges in, the horse is down;
He swims, the shore is near;

Anon his hand is on the bank,
A haggard face and hand;
"Give me thy beast," he tried to call,
As he struggled up the strand.

The man stood by the stable door,
Nor such demand would hear,
But holds the bridled horse by the mouth—
A dagger shimmered clear—
From the warder's dying grasp the Count
Ravels the bridle-gear.

A crashing sound through the forest goes,
A crashing and stumbling sound;
The branches groping about in the dark
Seem to girdle him all round.

He bends his scarped and bleeding brow,
Upon the saddle-bow,
Could he rid him of this wood so broad,
As of the warder dead—Oh, God!
By one quick dagger-blow!

Thro' the twisting of the trees
Rushing like a sudden breeze,
Or snakes among the autumn bowers
Through the mats of withered flowers,
Threaded the long-legged creatures twain,
Up and down, against wind and rain.
The fingered boughs checked not their speed,
Nor drive them from the rider's head;
He, blind and deaf, would seem to sleep,
While his staggering steed
Toiled fetlock deep.
It plunged, it fell with a dying heave,
As the blood from its nostrils ran,
But he rose from off the plashy sod,
Muttering sadly, "Thank my God,
I've yet the strength of a man!"

What steeple and what roofs be these
The moon lights up so fair?
What belfry shines the moon out-through?
And hark, what bell is there,
As if it fain would slumber too,
Like the slumbering street below?
Twelve times it swings. Now faint and slow
He climbs those steps as white as snow,
And sinks against the bolted gate:
"Who knocks?" cries the porter from within,
As he drowsily draws the wicket-pin;
But the amber eyes of the fiends look in,
And the porter runs in fear,
Runs and leaves him where he lies:
Then on his breast and on his thighs
These evil things alight.
"Now we have him, brother dear!
His breath is done, as I can hear;
Keep his mouth open, hold his thumbs,
The darling little spirit comes——
Turn him from the east——sweet sprite!
Come out! come out into the night!"

WILLIAM B. SCOTT.

THE WOMAN OF BUSINESS.

"A woman is a dish for the gods, if the devil dress her not."

Antony and Cleopatra.

Chapter I.

UP-HILL WORK.

"There are just two objections to your plan," said Woodville to his companion, in the *coupé* of the diligence, as it rolled and rumbled along the Simplon road, soon after leaving Domo d'Ossola, advancing towards the Lago Maggiore: "one is the unconscionable hour at which we must start to accomplish it; the other is the appalling length of the walk."

"Trust me," replied the more energetic Alexander, smiling—indeed, almost laughing outright—at the strong expressions his friend had employed; "you will be rewarded a thousandfold; the prospect from the summit of Monterone is, by all accounts, one of the finest on the south side of the Alps. We shall not only look down upon the lake of Orta, which so few English tourists visit, but we shall see Monte Rosa in all its glory by sunrise, and a wonderful range of mountains into the bargain. As to fatigue, that is a difficulty easily got over—you can take a mule or a donkey, and then you will have six legs against my two."

"If I surrender," said the less robust, or less adventurous, of the travellers, "it must be on two conditions; first, that you guarantee me a fine day——"

"That I do," said Alexander, intrepidly.

"And, in the next place, you must promise me two clear days' halt at Orta."

Alexander smiled and shook his head, demurring to the second clause. He felt quite sure one day would suffice for all the recruiting necessary after an excursion, which, to him, seemed a mere bagatelle. But Woodville would not bate a minute of the forty-eight hours, and, after some more discussion, his friend had no alternative but to yield.

"Ah, my friend," said the other, as soon as the point was settled, "I have neither your vigour nor your marvellous passion for up-hill work; you show it in everything as well as in mountaineering."

"Your profession does not exact the same continuous labour as mine," said Alexander.

"You are mistaken there," said Woodville; "there is no success in painting, any more than in law, or anything else, without the

energy and toil in which you exult, and of which I am constitutionally incapable. With your force and courage, I feel that I could be a Titian. Even now, after the compact I have made with you, I almost doubt whether I shall be physically equal to keep my part of the engagement. What will you do if you fail to get me out of bed at three in the morning?"

"There will be nothing for it but oxen and wain-ropes," said Alexander.

"Yet, after all," continued the artist, "I am not a sluggard in principle. How often do I slug in bed on the long bright summer mornings, speculating on the advantages of early rising, thinking of the wealth and distinction which men of your stirring habits are sure to win by their superior activity!"

"I love my pillow too," said his companion, "but I fancy I sleep more than you in a given time."

"Another proof of what I say: you sleep strenuously, as you do everything. I have never seen you at your work, but I can imagine what you must be at business, from what I have seen of you on this tour, which is only your relaxation. You seem to me to have an unnatural appetite for exertion."

Alexander made a gesture of dissent.

"I know you have," continued Woodville; "as you fix your eye on that peak yonder, you are burning to scale it. Its crags encourage you as much as they dishearten me. Confess, now, if the diligence were to stop for half an hour, you would at least make the attempt."

Alexander neither admitted nor denied the impeachment; he merely said, that in his opinion, what seemed to be in some men a passion for toil was in many cases the mere result of a still more ardent passion for repose. "Would you know," he added, "what the object is at the bottom of all my plans, as far as I know myself, the *terminus*, to use a technical phrase, to all my aspirations? Do you see that old peasant at his cottage door, basking in the setting sun? He looks as if his working-days were over; he is seated under a tree of his own planting, enjoying, literally eating, the fruit of his own industry. Well, I am not conscious of any more elevated motive than to attain to that poor husbandman's fortune, and after some thirty or forty years of hard work at the Bar, sit down like him and spend the evening of my days under my own fig-tree."

Woodville was so long without answering that Alexander fancied that either his long speech, or the monotonous roll of the lumbering coach, helped by the advancing shadows of the hills, had lulled him to sleep; but in fact his sentimental friend was only musing with half-closed eyes in his corner on the beautiful though hackneyed image with which his companion had left off. He was also fixing in his memory, for the subject of a future sketch, the details of the

rural picture to which his attention had been drawn. It had just the kind of interest to invite his indolent poetic pencil, a lovely bit of landscape, with a thought and touch of humanity in it. In such subjects Woodville's talent lay, and he might have been without a rival in it, had it not been for the half mental, half physical infirmity which always prevented him from doing his fine conceptions justice. He threw a charming thought upon canvas, or into his sketch-book, and left it there; began a hundred subjects, and seldom finished one. He would paint one side of a face exquisitely, with an eye to haunt your memory for ever, and leave the other for a future day, which never came. His studio in Paris, in a quatrième of the Faubourg St. Honoré, where he had lived for some years, and where Alexander first made his acquaintance, was a museum of abortive undertakings, evidence of as much genius as can exist without the power of sustained exertion. His very art was a proof of his instability, for he had not been brought up to it, but had dropped the medical profession for the pencil; he had actually taken a degree in medicine, but nothing annoyed him more than when a friend in ignorance or thoughtlessness called him Doctor, though every now and then he betrayed himself by the technical knowledge he displayed, particularly when he expatiated on his own complaints, of which he had a wonderful and amusing variety for a man who had never been seriously ill in his life. As to practice, he had as much now as ever he had, though he had only two patients; his old servant Honorine, when she was rheumatic or dyspeptic, and himself. He dosed both patients freely, but as his views had latterly been homœopathic, the harm his prescriptions did was probably only infinitesimal.

To return from this long digression. Woodville proved he was still awake by the one word with which he resumed the thread of the dialogue.

"Alone?" he said, looking full and interrogatively at his companion, who had, perhaps, been pursuing pretty much the same train of ideas, or after so long a pause he would have hardly understood that the question related to the fig-tree.

"Probably," said Alexander, with a smile; "the peasant was alone, as you must have observed."

"His better half was probably within doors," said Woodville; and as he spoke, the wheels ceased to rumble, the bells to jingle, and the diligence stopped, amidst a jabbering of beggars and ostlers, in front of the principal inn of Baveno.

Now there is an hotel there of considerable pretensions; but its best inn was a poor one between twenty-five and thirty years ago, which was about the date of Frederick Alexander's first continental tour. Italy, indeed, is not an eating country; she has made great advances in freedom, but in gastronomy she is behind the age. We

must only hope that, when her political organisation is complete, she will begin to cultivate the arts of the kitchen, and remember that she is as much the land of Apicius and Lucullus as of Cicero and Dante.

Our tourists had as sorry a supper served up to them as any cook in the whole peninsula could have prepared; but, under the circumstances, this was no great trial of temper to either of the young men: the one was too fresh, and had too healthy an appetite, to turn up his nose, at the end of a long journey, at any dish that was eatable; while the other was too jaded and done up, after thirty-six hours' tumbling in the diligence, to care much for anything but a bottle of wine and his pillow. Indeed, their project for next day was argument enough for roosting with the least possible delay, which poor Woodville did in half an hour after their arrival, leaving his friend at the table charged, as usual, with all the necessary arrangements for the morrow's expedition. It diverted Alexander, though he took care not to show it, to observe the apprehension with which the nervous and vacillating artist evidently contemplated a march, which was no great feat, even in those days, when there was no Alpine Club in existence. Woodville made an unavailing attempt before he retired to reopen the question, suggesting the propriety of quietly circumnavigating the Lago Maggiore before they left its shores, but Alexander was as steady as a rock to the programme that had been arranged. They were to return to the Lago Maggiore by way of Arona, and from thence take all the lakes in order.

Left to himself, the young barrister (he was in about his three-and-twentieth year, two or three years Woodville's junior) first finished his supper, even clearing off two plates of walnuts and dry biscuits, which had probably been destined to do duty for the whole of the touring season. Then he hired a guide, with two donkeys—one for his comrade, one for the luggage—after which he called for the bill, settled it while he was undressing, and in less than five minutes was sound asleep, sleeping unconquerably through all the opposition which a sultry night in August, conspiring with legions of mosquitoes, offered to his rest. Poor Woodville, on the other hand, notwithstanding his extreme fatigue, would hardly have got an hour's sleep in the face of such a formidable league, had it not been for a phial of aconite which he had always with him in his neat portable medicine-chest, that Alexander took to be the paint-box. In fact, the artist seemed to himself to have scarcely closed his eyes when he was startled by the matin song of the asses under his window, as they were led into the court-yard. He dozed again for a moment in the midst of this agreeable serenade; but it was short-lived bliss, for now came his ruthless companion tapping at his door, and thrice was the tap repeated, always *crescendo*, before Woodville realised its terrible significance. The third tap was accompanied with sounds

still nearer and more appalling. A strong hand was laid gently on his shoulder, and a hollow voice, not without pity in it, accosted him with—

"Woodville, your hour is come!"

Alexander was humane enough to feel that he was almost acting the part of Abhorson in the play, when he requests "Master Barnardine to get up and be hanged."

But Woodville proved a man of his word, and the oxen and wain-ropes were not wanting, although the clocks of Baveno were only striking three as they left the hotel. The guide went first, leading the beast that carried the baggage; Woodville followed on his own animal, which really looked as if it had six legs, those of the rider being rather long, and almost touching the ground. The rear was brought up by the bold limb of the law. On one point he had been rather too bold; in covenanting for the weather he had gone a little too far. When they started, however, it was still too dark to read the signs of the sky; as they looked back over the lake even the white terraces of the Isola Bella were scarcely distinguishable in the grey gloom, but the air was fresh and balmy, and had such a stimulating effect on Woodville, that he soon began to forget his grievances, and finding his seat tolerably easy at first, his spirits rose, and he felt even grateful to his friend for combating his *vis inertiæ*. The ascent was tedious, for the long-eared brutes had their inflexible regulation pace, beyond which, on the most favourable ground, a forest of cudgels would have failed to urge them; but it was so much the easier for the friends to chat. Alexander asked how the artist had got through the night. He had found his own bed clean and comfortable.

"The beds are often better than they look," said Woodville, "but it is not enough for me that a bed is clean; it ought to be, like Cæsar's wife, not only clean, but above suspicion. There may have been no jumpers in mine, but everything about it suggested that there were; that was enough to put comfort out of the question."

"Don't we do those little jumpers injustice?" said Alexander; "we complain of finding them in our beds, yet where else should one expect to find them? A bed is their *habitat*, as naturalists call it; we go to them, they don't come to us."

"Happy man!" cried Woodville, "who can make a joke of all the troubles of life; nothing fatigues you, or worries you, or bites you. If you were an Irish Catholic, you would think the Protestant Church a laughing matter; if you were an Italian, you would be as patient as Job under the Austrian dominion."

"No, no," said Alexander, warmly. "If I was an Irish Catholic, or, indeed, if I was an Irish Protestant, I should never rest while the Church existed; if I was an Italian, I should never be contented while a German swaggered in the Peninsula."

They were in the middle of a discussion on the prospects of Italy, which at that period seemed hopelessly gloomy, when, happening at the top of a sharp rise to face about towards the quarter they came from, the lake, of which they had seen the whole expanse a few minutes before, had disappeared from their view. While they had been chatting, a dense mist, born of the heat of the previous day, had stolen a march on them; and, what was worse, it seemed to be climbing the hills as fast as themselves. Both looked blank, and Woodville reminded his companion of his unlucky guarantee. Alexander put the best face on it, and declared that these Italian mists were of no consequence; they were not like Scotch mists, and he called Woodville's attention to the brow of the mountain, which was perfectly clear. In five minutes they should reach it, and in three more the sun would be up in all his glory.

"Ah, false prophet!" cried the artist, when the five minutes were expired, and they stood indeed on the crown of Monterone; but it was like standing on a few square feet of rock in the midst of an ocean of vapour.

Still Alexander's faith was strong; the vapours would vanish as quick as they came, the might of the sun would disperse them as a justice does a mob with the Riot Act, and then,—then they would see the grandest spectacle in Europe.

But the sun either refused to do his duty, or the mists were too rebellious; instead of dispersing, they became rapidly condensed into a fine rain, which soon made Woodville feel that in imitating the early bird, he had brought on himself the fate of the earlier worm. Not even then did the spirits of his friend fail him; and, to keep Woodville from sinking entirely, he insisted (while loading him with all sorts of wraps) on detailing all that he would, could, and should have seen, only for the treachery of the day.

"There," he cried, pointing in one direction, "there is Rosa, the second mountain for sublimity in the Alps, scarcely second to Mont Blanc; I almost fancy I see his outlines, but, no, he is totally invisible. Far southward the cone of Monte Viso—follow my finger; not a bit of him to be seen either. Now carry your eye half round the horizon, northwards, and you come to another giant,—I forget his name,—lost in the fog like his betters. Milan is yonder, as plain as I see you, only for this provoking revolution in the weather, which prevents one from seeing anything. Orta must be just below us, but the fact is, we can see nothing."

"A good reason for not staying here any longer," said poor Woodville, who was all this time shuddering with cold on his donkey, but too dejected to check his friend's enthusiasm, which was certainly rather untimely.

To make matters worse, not only did the rain increase until it

thoroughly drenched them—even Woodville through all his wraps —but they had not been descending long, before the track they had been following was suddenly lost, and when they attempted to confer with the guide they were unable to understand his patois, but he was evidently as much bewildered as themselves; so after groping about for some time, trying in different directions, there was nothing better to be done than to trust the asses, who had probably often made the same journey. The beasts, however, were not so well acquainted with the town of Orta as they were with another place, called Omegna, on the same lake but distant from Orta by several miles. At Omegna, accordingly, our travellers arrived, early enough in the day, but in such a pickle as to make it necessary to stop many hours at a wretched cabaret, which could scarcely afford either a breakfast or fire to dry their clothes. The latter was the chief point, and, as soon as it was tolerably well effected, they hired a boat, which landed them late in the evening under the balcony of the Leone d'Oro, the only inn at that time in Orta.

Chapter II.

THE LEONE D'ORO.

The lake and little town of Orta, now as familiar as Hampstead Heath to every cockney tourist, were at the period in question not much better known than the Dolomite Mountains, or the gorges of the Sierra Morena. The situation of the inn, under which our travellers landed, is charming, it stands out so picturesquely into the glassy water, with its roses dropping their leaves, and its vines their clusters upon its breast. The Leone d'Oro, which still exists (flourishing would be too much to say), is fairly entitled to add a small percentage to its bills, on the score of its position, and the delicious views from its windows and galleries, opening on the lake.

When Alexander, leaving his wearied and disconsolate companion sitting, enveloped in a Scotch plaid, as if the sun was in Capricorn, on a bench of white marble which was still warm (for at Orta it had not rained at all), entered the vestibule, the little inn seemed either deserted or asleep. He looked about for a bell, but probably there was no such thing in the town, save those of the adjacent convent, or in the campanile of the parish church. He liked the Leone d'Oro all the more for having no bells. So he passed into a room that seemed to aim at being a salle-à-manger, but finding this also as still and empty as a rifled tomb at Thebes or Persepolis, he made his way to a place that affected to be a kitchen, but was also forsaken, and in temperature felt alarmingly like a grotto. This was

discouraging, but ere he had time to be provoked, the hostess made her appearance, seemingly by accident, a comely woman of middle age, whose cosy person contrasted favourably with the desolate state of her house, and whose bright and affable eyes were pledges of at least a hearty good-will to do the best she could for her customers. Aided, perhaps, more by his own good looks (for Alexander was a tall, handsome fellow, with clustering brown hair, and had bright eyes in his head) than his acquaintance with the good woman's tongue, he soon came to a perfect understanding with her, and his first care was to provide a comfortable room for Woodville, and see that his sheets were well aired, a point about which he was not a little punctilious.

A common apartment looking out on the water was, of course, indispensable, and on that point there was no difficulty, for he might have had all the rooms in the albergo; the wide world of the Leone d'Oro was all his own. His own little chamber was one of a suite of similar rooms, all of which opened upon the airy gallery already mentioned; it had the merit of being clean, though rudely furnished, and was curtained with a glorious old vine, which twisted itself like a great serpent round the pillars that supported it, pushing its lithe branches through every interstice of the balustrade, from which he could have dropped plump down into the lake.

Woodville was too indisposed—whether it was fancy or not—to want anything but some posset or another, with a thimble-full of brandy from his own flask in it, which posset, when his friend had ordered, he prudently left the subject of his own dinner, or rather supper, to the landlady's discretion, confiding, however, more in her good dispositions than in her power to give effect to them. But there were always eggs, coffee, and fruit; the lake was sure to furnish some fish, and at that period a flask of tolerable wine was not so hard to find in any part of Italy as it was in later years, after the divine grape caught the distemper, which caused you and me, and all honest fellows, such deep and heartfelt concern.

As soon as the warm drink was ready, Alexander took it himself to Woodville, whom he found sitting on the side of his bed, in a queer old dressing-gown, his hands miserably folded, and so dismal that he might have sat for a picture of blameless insolvency. It was hard to help laughing at the length of his face, long enough at all times, but now longer than ever, he was so chop-fallen, and besides a two days' growth of a sandy beard added something mildly savage to his physiognomy. No doubt he was inwardly execrating Switzerland and Italy, mountains, lakes, forests, and waterfalls, and all that had tempted him to leave his tranquil garret in Paris to be drenched to the skin on the top of Monterone. Alexander knew all this perfectly well, but he did not know the worst and most indescribable

of the poor artist's grievances, which related to his six hours' ride on the back of the donkey. He was just recording a vow that no force, persuasion, or argument should ever induce him again to expose himself to such torture and indignity, particularly as his box was provided neither with spermaceti nor diachylum, when Alexander came in; and hoping to cheer his friend, while he was dropping the cognac into the drink, he repeated what he had gathered from the landlady about the weather, that such a morning as they had on the hills was quite exceptional at that season.

"I suspect the exceptions are tolerably frequent," grunted the dejected artist.

"But you know," said his friend soothingly, as you talk to a peevish child, "the exception proves the rule."

"From which, I suppose," muttered Woodville, "we are to infer that the more numerous the exceptions the stronger the proof. I know to my cost what exceptional weather means; I never went anywhere in my life at home or abroad for the sake of a holiday, or change of air, or climate, without finding it exactly the contrary of what I had been promised;—but it was always exceptional,—that was always the word."

Alexander knew this pettish fit would pass with a good night's rest, but not before it, so he made as if his dinner was cooling, and left his companion to get into bed. But there was still a moment to spare before his dinner came, and from the balcony through the foliage of the old vine he enjoyed a view which repaid him for what he had been cheated of in the morning. If he missed the sunrise, there was a sunset to make him amends. The lake glowed with all the lovely combinations of colour which you see on the necks of doves, or breasts of golden pheasants, the sky lending its glories liberally to the unruffled water. The terraces and white walls of San Giulio were bathed in rose rapidly deepening to vermilion; the mountains seemed pressing in all round as it were to take charge for the night of the sleeping beauty of the lake, and the hamlet on the opposite side seemed already buried in slumber under the shadows of the great chestnuts for which Orta is famed. The languor of the hour and the clime was over everything, but it was the languor of life, and the scenery pleased Alexander more than the severer beauty north of the Alps, which might have been expected to be more in tune with the boldness and vigour of his character. But the handsome young lawyer was as genial and social as he was strong, and the Alps rose in his esteem when he saw their savage grandeur softened, as it was here, by all the varied opulence of Italian vegetation. The convent bells, too, which were now filling the air with tinkling music from the adjacent heights dedicated to St. Francis (suggesting refection, while perhaps they only meant to invite him

to prayer) disposed him to be even more than social, even to be convivial, just at the moment when he was called to supper, and through the defection of his friend, was forced to sit down to it alone.

There are men who will tell you solitude spoils their appetite; but Alexander was not a man of that kind, and though he preferred company, the want of it did not prevent him from doing justice to the omelet, the frittura, and roast fowl which were set before him, and which, with cheese, coffee, and a bottle of the best wine to be had, proved the resources of the Leone d'Oro not so deficient as first appearances threatened. In short, he thought all so good that his wonder grew how such cheer was to be had in an inn which could only boast of two guests in the height of the summer. "Can it really be true," he asked himself, "that no travellers before ourselves have ever had the good sense to turn aside from the beaten route to visit this attractive spot?

"'Are we the first
That ever burst
Into this silent lake?'"

It was not very likely, in such circumstances, that they kept a travellers' book, but the rarity of a guest would perhaps make them the more careful to record the arrival of one, when such a secular event occurred.

At all events he would ask the question. The Leone d'Oro did keep a book. If it had few visitors it made the most of them. The book was brought him, but he turned over the entries of seven years scarcely finding the names of as many Englishmen. For the last three years, however, the names of a Mr. and Miss Evelyn appeared uniformly in August, and, with a curious precision, always on the same day of the month. They had, moreover, as the entries showed, always come from a place called La Tour, which Alexander learned from his itinerary was a town in the Vaudois country, so renowned in history for the struggles and sufferings of its people in the cause of religious liberty.

"Three times!" thought Alexander. "The Evelyns, whoever they are, if they are not the original discoverers of Orta, know at least how to appreciate it. I honour their constancy, but I fear it is exhausted; already they are a day behind their time, so they will probably return no more."

With these reflections he drank the last glass of his bottle, strolled to the top of the Monte Sacro by what remained of twilight, and went to his bed.

Chapter III.

THE GIRL OF BUSINESS.

At Orta they do not eat their nightingales and thrushes so systematically as is the general barbarous usage in Italy—at least, they had not eaten them all up at the period of our story; for there remained a choir quite large enough, at least, with the help of the convent-bells, to have roused Mr. Alexander at a very early hour, had he not required a little more of Nature's soft nursing than usual to set him up after the fatigues of the last two days. In fact he slept until near seven, and even then lay on his back for a few minutes, which was also against his usage, just to deliberate what might be done before breakfast, as well as during the day.

While his thoughts were thus occupied, he fancied he heard a stirring and rustling in a room adjoining his own, and which he now perceived was only separated from it by a slight, and perhaps temporary partition. He knew it was not Woodville's, for that was on the other side of the corridor. Presently a voice, or voices, were also audible; it was easy to distinguish that they were female voices. One was remarkably articulate and silvery, and evidently that of an English girl.

"Ha," said Alexander to himself, "this is Miss Evelyn, no doubt; they must have arrived during the night, or at a very early hour this morning. They are tolerably punctual, I must do them the justice to say."

He now heard the casement opened, which gave access, like his own, to the vine-wreathed balcony, and at the same instant the lady, with the more youthful and articulate voice, broke forth into a rapturous address to the lake, of which, without hearing every word, he was easily able to gather the tenour. She vowed it was lovelier than she had ever seen it before; she said the foliage was richer, the roses sweeter, the grapes larger,—everything was more beauteous than ever. Over and over again she vowed it was the sweetest spot in all the world, and once or twice she even called the lake her own, which made Alexander think that she must indeed have been the original discoverer.

After this burst of girlish enthusiasm, her tone was a little altered, but still her next-room neighbour could collect very distinctly that she was delighted on her father's account even more than her own to find herself once more at "the dear, quiet, old Leone d'Oro."

The next observation was addressed to her companion, who was probably her maid.

"I trust, Hannah, we are the only people in the house?"

Alexander lost the reply, but it must have been in the affirmative,

for the mistress was heard to say that more visitors would destroy the charm of Orta and quite ruin the Leone d'Oro.

It was a pleasant idea of Miss Evelyn's, that of an inn ruined by its guests!

She seemed next to be inquiring about some books, hoping nothing had been left behind; and she called for a certain list in a different key from her rapturous speech at the window—not at all harsh, or vixenish, only a little dry and peremptory. The list must have been handed to her, for Alexander could hear her murmuring over a number of names in succession, obviously telling off the volumes they referred to, which appeared to be all forthcoming, except a certain account-book, about which there was a to-do. The title of the missing book sounded funny to Alexander's ear. It was called "the little green Bobbio account-book," and it would evidently be a serious affair for Hannah if the book with this droll name had by any chance been lost or even left behind.

All this occupied so short a time, and the young lawyer's curiosity was so much excited, that it only now occurred to him that he was rather in a false position, placed so as to overhear the conversation of a lady who not only was not aware that his room was occupied, but was under the impression that she and her father were the only guests in the house. To make any sign now, by coughing, or in any other way, would be almost to confess himself an eavesdropper; so that he was quite at a loss what to do, and it was a great relief to him when in a few minutes both mistress and maid left the room, probably to go in quest of the missing treasure.

You may suppose he had plenty of food for his thoughts and employment for his faculties of divination, while he made his expeditious but not negligent toilette, a little more careful certainly than it would have been if the Evelyns had not arrived. Alexander was not yet much of a lady's man, or a deep student of the sex; but he had never been so perplexed as he now found himself between the conflicting indications of character out of which his fancy had to frame a notion of Miss Evelyn, with only her voice and a few scraps of dialogue to guide him. She was a very young lady by her enthusiasm, and not so very young by her careful habits. She was wild about scenery, and a martinet with her maid; had a passion for roses, yet kept accounts; and, lastly, she arrived after he had gone to bed, and yet she was stirring before him. Was there ever such a curious medley? Was there ever such a riddle of a girl?

However, it was not to solve enigmas, much less to keep accounts, that he had come to Orta; so as soon as he was dressed he sallied forth, mortified a little at finding that he had already lost so much of the morning. In the kitchen, through which he passed, having missed his direct way to the inn-door, he found my lady's maid (a

tight girl of thirty, neatly dressed in a crisp blue calico, black apron, and smart cap fluttering with pink ribbons) in an altercation with the hostess on the subject of breakfast, the difficulty arising, as usual in such cases, from the mutual ignorance of the parties of each other's tongue. Hannah wanted new-laid eggs, and as the landlady neither understood English nor French, at least the French that Hannah spoke, the girl was reduced to the primitive expedient described in the old rhyme—

> "If I wanted bread
> My jaws I set a-going,
> And asked for new-laid eggs
> By clapping hands and crowing."

Through Alexander's intervention the difficulty was soon got over, and the maid was profuse of her thanks and curtsies for the assistance which her obliging countryman gave her to settle it. Alexander then gave his own instructions for breakfast, at which meal he expected to be joined by his friend, and in the meantime there was half an hour at his disposal, time enough for a row to the island and back again. On the little quay, which was hard by, he found an elderly gentleman, who of course was Mr. Evelyn, inquiring about a boat for the same purpose, but for a later hour, after the heat of the day had subsided. They saluted one another without speaking. Alexander selected his boat, and the elderly gentleman returned to the inn.

Alexander was pleased with Mr. Evelyn's exterior; he was a tall man, probably over sixty; he seemed to be in feeble health, and stooped considerably, his hair was nearly white, his face long, pale, and intellectual, but its expression was amiable and benevolent, rather than suggestive of mental power or force of character. In these days he would have worn some strange form of hat, and been attired as if he wished to pass for a horsedealer or a gamekeeper, but at that time those fantastic costumes had not been introduced with which Englishmen of later years have supplied the caricaturists with such fair subjects for their pencils. Mr. Evelyn, on the contrary, was dressed with care, and much as he would have been in the same season, had you met him in Pall Mall or Regent Street; a blue frock, trousers of nankeen (a stuff now only to be seen in the Kensington Museum), and an ordinary white hat, only that the leaf was a little broader than usual.

As to Alexander's outer man, of which as yet we have said nothing, it is enough to say now that it was in the same taste as the old gentleman's, scarcely more juvenile, but of stronger materials, more fit for hard work and vicissitudes of weather. His appearance and bearing had in turn made a favourable impression on Mr. Evelyn, but Hannah had already saved him the trouble of describing the

stranger for his daughter. On that lady, however, her maid's account of Alexander, though in terms of exaggerated praise, to repay him for his civility and good offices in the affair of the eggs, was completely thrown away.

"Only think, papa," she exclaimed, advancing to meet her father from the breakfast-table, where she had been making tea, "these provoking tourists are finding out Orta at last; there are actually a pair of them, and English ones too, in the house at this instant."

"Not *in* the house, at all events," said Mr. Evelyn, smiling and kissing her. "One of them is in the middle of the lake by this time."

"You take it very quietly," rejoined his daughter, with a curl of vexation on her lips; "but I consider it a monstrous intrusion, I can tell you."

"Two, after all, is no such great matter," said the old gentleman, taking his seat.

"Two will bring twenty, sir. Mr. Smith and Mr. Brown are sure to be followed by Mr. Jones."

"Ay," said her father, affecting to be deeply concerned, "and then the Robinsons are inevitable. I presume the young man on the water is Mr. Smith?"

Here Hannah, who was standing by, interposed with fervour to explain that it was a much prettier name than Smith, his name was Mr. Frederick Alexander; she had seen it in the travellers' book, and his companion's name was Mr. Woodville; and Hannah took care to let her master know that but for Mr. Alexander he would have had no eggs for his breakfast.

"Come, Fatima," said Mr. Evelyn, "these are strong points in his favour: he is not Mr. Smith, and we are indebted to him for our eggs."

The outraged lady vouchsafed no reply, but packed Hannah away to inquire about the hours for posting and receiving letters, directing her to bring back the information in black and white.

"She is so inaccurate," added Miss Evelyn, when the maid's back was turned, "so very careless. Only think of her leaving behind, either at Ivrea or Chiavasso, I suppose, one of the account-books, and the Bobbio book of all others; all our disbursements in it for the schools and charities. What shall we do if it is lost?"

"It will vex you," said Mr. Evelyn, "more than it will the good folk at Bobbio. I remember an anecdote of Henry VII., who kept a memorandum-book in which he entered the daily expenses of his palace. His favourite monkey got hold of it one day and tore it up in pieces, to the inexpressible delight of the officers of his household. But your book will be perfectly safe, depend upon it; we shall find it on our way back to Turin."

"I am sure I hope so, papa; for that good old man at Bobbio has no more notion of regularity or keeping accounts, or business of any kind, than Hannah or——"

"Myself, I suppose," interrupted her father.

"Very well, papa, I never contradict you, but really these primitive Christians are very hard to manage; I was obliged to leave Bobbio, after all, without the vouchers, but I do hope the post will bring them to-day."

"You are quite right, my love, to make them mind their p's and q's."

"I am resolved they shall mind them; and now come and see how nicely I have arranged your table for reading and writing until the sun goes down a little; and you see where I am going to fix myself opposite to you."

Mr. Evelyn's table had very little of the air of business; there was a writing-case certainly, but it was not open, as if he seldom used it, and wrote most of his letters by proxy. His books and newspapers, on the contrary, were arranged before him convenient to his hand; among them were several reviews and other new publications, both French and English, all indicating the habits of an easy reading man; the only business-like phenomenon was a bundle of papers tied with a bit of pink ribbon, but it lay at one side upon the unopened writing-case.

Nor, indeed, was there anything ostentatiously busy or official about Miss Evelyn's establishment in the opposite corner. On the contrary, the ordinary feminine phenomena predominated. There was a little row of volumes, some of which looked like small editions of the Italian poets, others were perhaps novels. There was a small writing-desk, evidently much more used than her father's, and even a plainer one; but there was a work-basket also. The little red books on the desk labelled with the words "Torre" and "Angrogna," were probably the companions of the green one which was lost or missing.

While Miss Evelyn was carefully arranging the *jalousies* so as to temper both the light and heat, yet so as to admit whatever air was stirring, which was not much, and also to afford a peep out on the water through the vine, Hannah returned from the post-office, and brought letters and papers with her. Among the former was a fat one from the pastor of Bobbio with the expected documents. The young lady's eye sparkled with triumph.

"You see, papa," she cried, holding them up as if they had been prizes in a lottery, "the effect my letter from Turin has produced."

"I hope it was not too sharp, my love," said the old gentleman, opening a newspaper.

"It has brought the vouchers, papa—that's the great point," she

replied as she seated herself at her little table. Then she added, after a moment's pause, "Really it is most important for their own sakes to teach these poor people a little regularity in money matters. Our fund goes much further now than it used to do, when nobody knew how the money went, as was the case a few years ago. 'On a changé tout cela,' I hope."

From that moment for two or three hours there passed but little conversation between father and daughter; he was engrossed with his books and newspapers, she with her Vaudois accounts. It was pretty to mark the ringed and rosy finger run up and down the columns of figures, and the musical murmur with which she carried the tens; it shed a hue of poetry over arithmetic. It was very pretty also to note her momentary embarrassments, for they were only momentary, as if she had carried over a franc or centime too much or too little, or had caught the slovenly accountants of the Protestant valleys tripping; and how the transient difficulty sometimes told on her bright, intelligent brow, clouding it; sometimes on her lips, compressing them the least possible; sometimes, but that was very seldom, going down so low as to affect the foot that peered out from beneath the sweep of her plain morning dress (not half as smart as Hannah's), making the extreme flounce scarce rustle with its movement. It was pretty, too, when the difficulty was brushed away almost as soon as it occurred, and the light returned to her brow, and foot and flounce were still again, and to reward herself for her successful pains, or her impatience subdued, she smelled vigorously at a vase of roses which Hannah had placed at her side, or jumped up and kissed her father in the middle of his reading.

Chapter IV.

ON THE WATER.

Mr. Woodville was still a martyr to the cold which his stirring friend had given him in pointing out the sublimities not to be seen from the "misty mountain top," but he was not too ill to keep his breakfast engagement, or play his part at the table with respectable efficiency. Indeed he thought it necessary once or twice to apologise for his appetite, which he declared was a morbid and hysterical one, and no proof, as it would be with another man, of any strength or stamina in his constitution.

Woodville had the advantage of Alexander, for he had actually got a peep at the enigmatical young lady, but she was a puzzle to him also, for he could neither pronounce confidently either as to her age, or her pretensions to beauty. What he chiefly noticed was a

look of decision and an air of originality which tallied with the inferences his friend had drawn.

"In short," said Woodville, "I think we may sum her up tolerably well by saying she is a pretty, clever, odd sort of a girl, with a will of her own, and a speciality for double entry."

As soon as the artist heard the name was Evelyn, he at once remembered that he had often heard in Paris of a gentleman of that name, who was noted for his eccentricities, the nature of which, however, he could not recall to mind.

"I doubt very much," said Alexander, "if Miss Evelyn has bestowed as much attention on us as we have upon her."

"I am positive she has not," said Woodville, "so let us follow her discreet example. Shattered as I was—you laugh, but I am quite in earnest—I made an effort this morning to make a sketch of the old man under the fig-tree, while the subject was fresh in my memory. Would you like to see it?"

Alexander thought the drawing beautiful, and truly so it was; it was just the theme which Woodville's wayward pencil handled most lovingly.

"What thought, what feeling you have thrown into it! And what is very strange the old man strongly resembles my father, whom you never saw."

"It is not surprising," said the artist, "as I had your own green old age in my mind's eye. Excuse me for grizzling your hair before your time, but I often amuse myself with speculating on the future of a face or a form; to me there is as great a charm in the autumn of human life as in the autumn of the woods and mountains."

"I shall be fortunate," said his friend, "if I ever arrive at such a mellow October. But come, since you are in such a good vein for sketching, you must go on the lake with me in the cool of the day; the views will be sure to inspire you afresh, and to-night we shall have a moon."

Woodville's face prolonged itself immediately, and he shook his head dubiously; he feared it would be too much for him, that it would affect his trachea, or his uvula, or his bronchial tubes, parts of the animal machinery, of the very existence of which Alexander was in happy ignorance; but the temptation was too strong, and his friend, having prevailed, left him to himself until dinner-time.

When the hour for the water came, the Evelyns, who were also bent on the lake, were the first at the place where the boats lay, but it accidentally happened that the only boat to be had was the one which Alexander had hired.

Here was another *casus belli* against the tourists, who had monopolized the one boat.

"I told you, sir, what it would come to," said Miss Evelyn, with a sort of composed vexation, as if she had made up her mind that she was no more to be lady of the lake.

"Perhaps our hostess will be able to procure a boat for us," said the old gentleman. So they returned to the inn, and were in council with the landlady in the porch just as Alexander and Woodville were setting out, the latter wrapt up as if the November winds were blowing. Miss Evelyn had an eye for the ridiculous; it was easy to see that, as it twinkled through the half-closed lids for the twentieth of a second upon the artist as he passed; he would certainly have made a different toilette, could he have anticipated the criticism of that rapid but comprehensive survey. With equal rapidity Alexander had perceived the difficulty the Evelyns were in, and to place his boat politely at their disposal was the affair of a moment.

Mr. Evelyn thanked him profusely, as did his daughter also, though in few words and with a little state.

"I am twice your debtor, sir," said the affable old gentleman, "for my breakfast this morning, and again for your present kind offer; but the boat is large enough for us all, and it is not unlikely that our projects coincide."

This suggestion settled the matter, agreeably to Alexander at all events, and the Evelyns led the way to the place of embarkation, where they found Woodville resting. He was by no means so well pleased as his friend at the arrangement made behind his back; the sparkling criticism of that bright eye of indeterminate colour disturbed him, and he would certainly have managed to shuffle off some of his wraps, only that unluckily his shabby old dressing-gown was under them, and to have exhibited that to Miss Evelyn would have been worse still.

"Perhaps we can dispense with the boatman," said the lady, and added, looking at Alexander, "I dare say this gentleman will have no objection to row."

Alexander took the oars not only with complaisance, but pleasure, for he was an expert waterman, and the young lady took the tiller, greatly to the artist's satisfaction, for he was afraid for a moment she was thinking of imposing the steerage on him. The young lawyer sat facing the lady at the helm, her father was at her right, and Mr. Woodville on her left, the only member of the party who was not at his ease. And yet without intending it, he was the first to amuse the party. Mr. Evelyn was sorry to see that Mr. Woodville was an invalid, and hoped he would soon get rid of his cold, which led the artist to give an account of the way in which he caught it, which he accompanied with such a *naïve* description of his terrible adventures in the storm on the hills, the miseries he endured on the donkey, and the pickle he was in, how his worst apprehensions of

Alpine dangers were more than realized, and how his companion only grew more and more elated and triumphant the more the horrors increased, that the Evelyns were extremely diverted—particularly the lady, who laughed heartily—at which Woodville was not at all offended, for he was not sorry to be entertaining, and was never ashamed to confess that he was no hero.

"I am afraid," said Mr. Evelyn, "we do not feel as much as we ought for what you went through; you have related it so agreeably."

"We shall be wishing you, sir, to make the ascent of Mont Blanc, or Monte Rosa," said the young lady, with a flash of pleasantry in her eye, as gracious as possible, not a bit of the expression which had made Woodville feel uncomfortable at the door of the inn.

"Do you propose any of those gigantic expeditions?" said Mr. Evelyn to Alexander.

"Not at all," he replied; "my heroism only exists in my friend's imagination; we are of the humblest class of tourists; we have crept through Switzerland, and are now creeping through the north of Italy, intending to creep homewards towards the end of September."

"To give you a notion," said Woodville, "of what Mr. Alexander understands by creeping, you have only to look at that enormous mountain yonder, over which we crept, as he calls it."

"The highest positions in life are often gained by creeping," said Mr. Evelyn, whose style of talk was rather pretentious; "I have seen many instances of it in my time; but I venture to predict that is not the way the gentleman rowing will make his way in the world."

Alexander thanked him laughingly for the flattering remark, and he might have thanked his daughter too for the smile with which she supported it. Indeed she spoke little, though she evidently enjoyed the water and the surrounding beauties extremely, but it was in a reserved and demure way; there was no more of the enthusiastic burst of the morning.

Mr. Evelyn ran on upon the different ways of rising in life; how few rose by straightforward manly climbing, how many by servile crawling, or wriggling, which he illustrated by the fact that even the eel, not a more slippery creature than many an eminent politician, will wriggle itself up a ledge of rocks or a salmon-weir. He had seen men in his time who wriggled themselves into bishoprics, and even higher positions.

Woodville was now so much at his ease, that after looking at his watch, he produced a minute phial of globules, no bigger than the heads of pins, and having dropped a certain number into the palm of his hand, licked them up with an apology—much called for—for taking medicine in company. He did not see, but Alexander did, how Miss Evelyn looked while he was taking his dose. It was

another of those little flashes of sarcasm darting out between the half-shut eyelids, which she had levelled at the artist's wraps.

"You are not a homœopathist," said Alexander, addressing her. The look made that plain enough.

She answered the question only with a slight negative movement of her head, as if she desired to avoid a discussion of the subject; but the old gentleman went off fluently on the virtues residing in molecules and infinitesimals, from which he dashed into the atoms of Epicurus, quoted Lucretius, and displayed a wonderful deal more learning than was level to the comprehension of his audience, or exactly in place in a boat on the Lake of Orta. It was evident he plumed himself on his talk, and talked to be admired. The young men soon perceived that they had only to listen respectfully to make themselves perfectly agreeable. When he came to his first pause, Woodville ventured a complimentary remark upon the wide range of his reading. This opened a new theme on which Mr. Evelyn expatiated again with the same fluency. He disparaged extensive reading with a fresh outpouring of it.

"Learning, Mr. Woodville, you know as well as I do, is the vainest of all vanities. What signifies being 'deep-versed in books,' if a man is 'shallow in himself,' as Milton puts it? And how well Shakspeare expresses the same thought—

> "'Small have continual plodders ever won
> Save base authority from others' books.'

But what long ago most thoroughly disgusted me with your prodigies of erudition, was an opinion I met in the works of one of the fathers of the Church, that the most ignorant devil has more learning than the most learned man that ever lived."

This quaint theological dictum made everybody laugh, and before the laugh was over, Mr. Evelyn had started again on the subject of demonology, with which he seemed also to have the most intimate acquaintance, quoting the Bible, the Koran, the Talmud, and twenty authors of whose very names Woodville was ignorant, and he knew rather more about books than his friend.

When the demons were exhausted, he stopped to take breath. The young men could see that though his daughter was proud of her father's talents and knowledge, she did not encourage him to talk—probably because he talked a great deal more than was good for him, as he seemed troubled with a dry, short cough. But he wanted no encouragement, only an audience, and having now that advantage he seemed determined to turn it to account. Though he had talked so much, he had not yet mounted his hobby, which had been for some years the cause of the Vaudois. The moment he got astride of that he became not only fluent but rhetorical, and gesticulated with his hands as if he had been speaking from a platform.

As he spoke of the glorious struggles of the people of the Valleys against the House of Savoy, and of the deeds of their heroic leaders, especially Henri Arnaud and his romantic career, he was really "the old man eloquent" for a few minutes. His eye gleamed with some of the fire of the contest he painted, and Alexander suspended the oar to listen to his impassioned strain. Woodville, always excitable, forgot himself to the point of half-revealing his old *robe-de chambre*, and as to Miss Evelyn, she listened with an admiration and a sympathy which she had not vouchsafed to her father's display of learning.

But the pitch was too high to be long maintained, and he was soon in a more prosaic region again, beginning to enlarge on the difficulty of managing charitable enterprises so as not to destroy the spirit of independence in the objects of our benevolence.

"How often," he said, "do we corrupt poverty when we flatter ourselves that we are relieving it? Charity must keep a close hand. We always try to make ours do so in the Valleys. I dare say, gentlemen, it would interest you to know how we manage our fund?"

"But don't you think, papa," interrupted his daughter, biting her lip ever so little, "it would be more interesting just now to land and observe the sunset?"

Alexander instantly pulled towards the island.

"Just as you please, my dear," said Mr. Evelyn. "I will take another opportunity of giving our friends an outline of our system—or rather *your* system."

Miss Evelyn bit her lip again, but it was impossible to arrest his volubility.

"She is our accountant," he pursued, "we leave all the financial department to her. You see a young lady before you unvexed by multiplication, unpuzzled by the rule-of-three, and unmaddened by fractions. I wish I could say that business perplexed me as little as it does her."

Alexander, whose eye was as quick as any lady's, saw how little this comical eulogy pleased Miss Evelyn, though she affected to laugh, which was the best thing she could do; so he made as if he was too intent on the oar to pay much attention to what the old man was saying, and with a few strong pulls, brought the boat to the foot of a flight of steps, and the conversation at the same time to a full stop.

As they mounted the marble stairs, Miss Evelyn took her father's arm, and murmured something in his ear, probably a request that he would not resume the subject of her skill in accounts before the strangers.

At least there was no more of it. Mr. Evelyn having talked himself out, now allowed his new acquaintances to talk, possibly wishing to know more about them; and Woodville was as communi-

cative as the most inquisitive old gentleman could have desired, and left very little untold about himself and his complaints, and then about his friend, and his talents, and his prospects, until Alexander was in the situation which Miss Evelyn had been in before, of feeling himself made slightly ridiculous by excessive praise. But as he had helped her, so she now helped him in turn, by remarking that they had sat too long on the cold marble; particularly, she added (with a sly hit at the artist's envelopings), as her father was not so well fortified as Mr. Woodville.

"Come away, sir," she said to the old gentlemen, "let us be merry and wise; if you catch cold you will never be able to keep your appointment next week at Turin."

"Don't mention it, don't mention it!" said Mr. Evelyn, with a sigh, as if the business alluded to lay heavily on his mind. His daughter folded carefully round him a plaid-shawl which she had brought with her, took his arm in hers, and led him away to the boat.

It was full time for invalids and old men to get home, for the twilight was over, and the owls from the old towers of San Giulio were beginning to hoot.

W. Marmion Savage.

NECKER AND CALONNE: AN OLD STORY.

"Maxime solutum et sine obtrectatore fuit prodere de iis quos mors odio aut gratiæ exemisset."—TACITUS.

In the spring of 1787 France was within twenty-four months of the Revolution. Great questions, which had been slowly preparing for several centuries, and rapidly ripening during fifteen or twenty years, were on the point of being summarily decided. Privileges criticised, no doubt, but still flourishing in full vigour and activity, tough enough apparently to stand against many a rude shock before they should finally succumb, were within three short years to be not only dead, but beginning to pass out of mind. All thinking men had long foreseen the Revolution—nay, had confidently predicted it. Yet, after all, it took them by surprise. It is easy to calculate how many days or hours you are from Niagara; but the rapids once entered, you may be wrong as to the minutes. And as historical facts cannot be soberly measured and judged by the man who has witnessed them or lived immediately after them, so is it no less true that the relative proportions of coming events are less distinctly apprehended as they approach and become of practical interest, than when they are first descried on the far horizon by cool speculation.

"Noi veggiam come quei, che ha mala luce
Le cose, disse, che ne son lontano;
Quando s' appressano, o son, tutto è vano
Nostro intelletto."

France had drifted under the shadow of the Revolution when Louis XVI. opened the Assembly of Notables on the 22nd of February, 1787.

The student who approaches the history of these eventful months, naturally seeks to discover their central point of interest. Of all the great questions awaiting solution, on which was the battle fought? What was the popular cry? Was it in Church or State, in the army or the law, in the tenure of land or the regulation of commerce, that men clamoured most loudly for reform? Nothing of the sort. The issue raised was infinitely simpler. Shall M. de Calonne continue in power, or shall he make way for M. Necker?

Necker was not an untried man. He had presided over the finances in the Maurepas ministry. Maurepas is a character we seem to know. "Nimble old man, who for all emergencies has his light jest; and even in the worst confusion will emerge, cork-like,

unsunk! Small care to him is Perfectibility, Progress of the Species, and *Astræa Redux;* good only that a man of light wit, verging towards fourscore, can, in the seat of authority, feel himself important among men. In courtier dialect he is now named 'the Nestor of France,'—such governing Nestor as France has." Under such a leader an earnest politician had an unsatisfactory time of it. Necker was an exceedingly clever man, and was possessed of many qualities which win, and some that deserve, popularity. He was not a great political economist, like Turgot; but he had a wonderful power of mastering financial details, which was equalled only by his skill in manipulating, or, as some said, in cooking them. The confidence reposed in him by great capitalists was unbounded, and, as is frequently the case with that tribe, blind and childish, they took for granted that he could work miracles, and he was gratified by their superstition. His intellect, not being under the control of a strong and simple character, embarrassed him by its very acuteness. "He viewed," says one who knew him, "every side of a question so elaborately, his prevision was so susceptible and scrupulous, that he could see nothing but difficulties." Even his admirer M. Louis Blanc allows that he was ever "hesitating between the shame of being useless and the fear of being too bold, undecided and perplexed just because he saw further than others."

Necker's ambition was enormous. Yet it was not exactly that craving for power which is felt by born rulers of men; it was rather a passion for fame, an ardent desire to shine before his contemporaries, to be blessed as the saviour of France. He was earnestly bent on doing good, but not by stealth; and his hunger for popularity seriously marred his statesmanship. While the austere and noble Turgot, in the depth of his love for the oppressed people, was braving its ignorant resentment, Necker was picking up a little applause by cavilling at the great economist in the name of economy. Turgot thought that public opinion stood in sore need of education, and he wished to educate it. Necker worshipped it: "L'un parlait au peuple en législateur, et l'autre en courtisan."[1] When others were in power he was inconsolable. It seemed to him something monstrous and unnatural that any one but M. Necker should flourish like a green bay-tree. "Je ne sais trop pourquoi l'opinion publique n'est plus à mes yeux ce qu'elle était. Le respect que je lui ai religieusement rendu, s'est affaibli quand je l'ai vue soumise aux artifices des méchants." At such seasons his appetite for incense was in some imperfect degree stayed by the adulation of his domestic circle, where an accomplished and ambitious wife, "lui vouait une sorte de culte."[2] But the malicious plots of the court and aristocracy to drive him from power did more than anything else to

(1) Droz, vol. i. p. 110.
(2) Droz, vol. i. p. 79.

endear him to the lower orders. They yearned to recompense him for the chagrin which they supposed him to suffer. The language of the popular journals became quite ecstatic; for instance: "Le cœur se serre en pensant à ce qu'il a souffert, à ce qu'il aurait pu souffrir. On cherche dans ses yeux à deviner les mouvements de son âme. C'est un père qui revient au milieu de sa famille, qui le chérit; quoiqu'il n'ait plus rien à craindre, on s'inquiète encore, on l'interroge pour savoir s'il n'a pas quelque blessure cachée qu'il ne veut pas découvrir de peur d'affliger ses enfants."[1]

The truth is that Necker's egregious vanity did him no harm with the public. When he talked with dignity about "un homme de mon caractère," when he laboured to impress on his chief "quelques unes des grandes idées morales dont mon cœur était animé," when he drew a portrait of the statesman whom France needed, "a man in whom intelligence is combined with firmness, prudence, and virtue, not affecting to conceal that she possessed at least one such treasure, the people took him at his own valuation. They greedily devoured his incessant appeals to public opinion, the style of which, though diffuse and hardly rising to eloquence, was lucid and attractive. He occasionally fell into language which some have admired as the genuine outburst of a philanthropic heart, and others have denounced as sentimental clap-trap. One rather famous passage may be quoted as a sample:—

"Almost all civil institutions have been made for the possessors of property. One is frightened, on opening the statute-book, at being met everywhere by this fact. One would think that a small number of men had divided the land between themselves, and then proceeded to make laws to unite and guarantee each other against the multitude, as they would make a fence in the woods to defend themselves against wild beasts. And yet it must be said that when laws of property, justice, and liberty have been established, next to nothing has been done for the most numerous class of citizens. What do your laws of property matter to us? they may say. We have no property. Your laws of justice? We have nothing to defend. Your laws of liberty? If we do not work, to-morrow we shall die."[2]

It is all very well to sneer at outbursts of this sort, or to denounce them savagely as unworthy of a statesman, but they tell on the masses. While fastidious or cynical politicians receive a warmly expressed sentiment with shouts of derision, and think reiterated allusions to it an effective way of baiting an opponent, it is being treasured in the hearts of the people. Even now there are those who are fascinated by Necker's gushing language. In the eyes of M. Louis Blanc he is a thinker who had calmly judged political economy and found it wanting, and is therefore to be set above Turgot. But Necker was not precisely the man to be in advance of his age. He was far enough from any shade of socialism, and even from a sincere relish for equality, as his latter writings abundantly

(1) Journal of Gorsas, quoted by M. Louis Blanc, ii. 467.
(2) Sur la législation et le commerce des grains. Conclusion.

show. The simple truth is that his intellect was rather flabby. Clear-sighted in details, hazy in his conception of general principles, he was eager to strike at this or that abuse, but he shrank with nervous dread from anything like systematic coherent thought in politics. He would assuredly have refused the deductions which seem to M. Louis Blanc to follow so obviously from such a passage as that I have quoted. "Chez Necker," says the judicious and impartial M. Henri Martin, "il faut bien le dire, la protestation en faveur des prolétaires reste à l'état de sentiment." In a word, it was soft stuff. When we read it we must remember that the great financier had already written plays, and was destined to compose not only a "Cours de Morale Religieuse," but a novel with the romantic title, "Suites funestes d'une seule faute."

Necker had resigned in 1781 somewhat hastily, because he found himself thwarted by his colleagues. Fully persuaded that he was indispensable, he made no doubt that in a few weeks he would come in again on his own terms. His retirement, however, lasted longer than he expected, and in the meantime things moved so fast that, when he did return, it was to face difficulties unprovided for by his counting-house philosophy. France, during the eclipse of her Necker, had been under the treatment of Calonne, and steps had been taken which, good or bad, were irrevocable.

"On the morality of Calonne," says M. Martin, "there is but one opinion; on his capacity there are two." This is a judgment which would have mortified Calonne if he had lived to read it. In the first part of it he would have acquiesced with little concern; but in the second he would have recognised that he was punished *par où il avait pêché;* for lack of ability was certainly not the cause of the evil celebrity he has obtained in history. There are statesmen who are too clever by half. In the absence of all sincerity and all genuine conviction their counsel is inevitably turned into foolishness; therefore posterity, undazzled by the momentary glitter, judging and rightly judging them by the ensemble of their policy,—if a series of manœuvres may be dignified by that name,—doubts whether they had any capacity at all—whether they were not mere mountebanks. Calonne was a man absolutely free from all prejudice or predilection in politics. It was perfectly immaterial to him whether he governed wisely or foolishly, on old principles or according to new lights, by the favour of the king or by the support of the people. His ambition was not of a lofty kind. It amounted merely to a determination to get to the top of the tree, to be looked up to by good society, to have the power of dispensing favours and distinctions among personages of a more exalted rank than himself, and he had no objection to govern well if it conduced to that result. To Necker such a position would have given no satisfaction, unless he could feel that he was

earning the approbation of good men. Calonne cared little for the approbation of any one so long as he could sit in high places. With him, the end being base, all means were equally eligible, either simultaneously or successively. When he entered on office, he laid down for himself the rule, that the first requisite for success was to inspire confidence. Necker had been able to raise loan after loan, simply because capitalists believed in him. His resignation had been looked on as a public calamity, because it was feared that the capitalists would lend to no one else. Unless Calonne could conquer their confidence, it was impossible that he could remain in office. Many an insolvent banker has kept afloat for years, and perhaps ultimately saved himself, by showing no signs of distress, when the least appearance of economy or retrenchment would have destroyed his credit. Calonne did but pursue this familiar method, not altogether despairing of ultimate success, but determined, at all events, to hold on as long as he could. No finance minister could play this game of brag at the present day, because public resources and public incumbrances cannot be materially disguised. But French finances under the *ancien régime* were as as absolutely a secret as the accounts of a private firm. The publication of Necker's *Compte Rendu* had for the first time thrown some light upon them; but they were still a mystery, and the more so that, in that celebrated state-paper Necker had considerably cooked them. The plan of Calonne was therefore not so wild as it seems; the best proof of which is that he *did* restore confidence, and *did* manage to bleed the capitalists to the tune of nineteen millions sterling in three years. But further, he saw that all Necker's popularity with the country had not enabled him to bear up against the dislike of the court; and he was determined not to lose the game for want of support in that quarter. To us it seems a proof of infatuation, that within three years of the Revolution a minister should still have been counting on court favour as an element of solid strength. It is easy to see Calonne's mistake now. But in France, up to that time, court favour had been the surest foundation on which power could be built. The minister was literally the servant of the king. His promotion was notified to him verbally by a simple valet de chambre. "Monsieur So-and-so, the King has made you minister." Calonne is not to be set down as a fool because he thought such a system might last a few years longer than it did. That sweeping reforms must soon come he saw clearly, more clearly than Necker, who desired them indeed ardently, but always slavishly overrated the strength of the old régime. The confidence of the people and the sovereign once gained, Calonne intended to appropriate some of the plans of the reformers, and, in his unbounded self-reliance, he flattered himself that his cleverness and tact would carry measures which had failed in more awkward hands. He is not the only

statesman who has been out in his reckoning, from simple incapacity, to comprehend the value of a decent reputation—even to an impostor.

For some time all went well. A knot of serious and earnest men, the partisans of Necker, might protest as they pleased against a worship of successful effrontery, and fret over the lengthened exclusion of their chief from office, but the popularity of the minister was considerable. Money poured in from the innocent capitalists, and was lavished on jobs in the interest of every one who seemed to be in a position to render support of any kind in return.[1] It is astonishing how easily people come to look upon the interests of the community as identical with their own. We are generally given to understand that Calonne's ministry was an undisguised scramble among the courtiers for the last plunder of the wreck. But it certainly did not appear in that light either to courtiers or people. "I was always certain that man would save France," said a great nobleman with genuine enthusiasm, "but I never thought he would do it so soon." The capitalists, as we have seen, were satisfied. If there was one province of France where the minister was likely to be ill-received it was Brittany. Did he give the Bretons a wide berth? Not a bit of it. He made a point of paying them a visit, harangued them with his usual bounce, smartness, and well-simulated candour, and left them shouting "Vive Calonne!" "A feat," says M. Martin, "truly incredible." All the world saw that he was borrowing. But what had Necker done but borrow? Necker's loans had amounted to upwards of seventeen millions sterling in five years. Necker had been valued just because he could raise loans; and now it appeared that Calonne could raise them, if anything, faster.

For three years was this game carried on. M. Louis Blanc believes that Calonne was deliberately making things worse, in order that the privileged classes might be driven into a corner

(1) "I told our friends at Warrington that there appeared to me to have grown up under the present Government a system of what I called, in regard to the public expenditure, making things pleasant all round. That means going from town to town, granting what this community wants, granting what that community wants, granting what the other community wants, and leaving out of sight that large public which unfortunately has not got the voices and the advocates ready always to defend it against these local and particular claims. I told you a story of a case where a candidate in the Government interest at this moment goes to a constituency and complains that he could not get a Liberal Government to surrender for £2,500 a debt due to the Government of £20,000, but that when a Conservative Government came in he found there was no difficulty at all in arranging the matter. Therefore he says, 'Return me to Parliament, and not a member of the Liberal party.'" (*Speech of Mr. Gladstone, Times, Oct.* 26, 1868.) "It is far more easy to work the Parliamentary machine by a lavish expenditure of money, than it is to procure, or promote, or insist upon any due system of economy. They make things easy by what is called greasing the wheels. I recollect only last session speaking to a very eminent member of the Conservative side of the House about the policy of the Government, and he said that their policy was to make the thing work by giving a little money all round." (*Speech of Mr. Bright, Times, Nov.* 11, 1868.)

and compelled to submit to reform; and the fact that, after all, he exaggerated the deficit in his statement to the Notables does seem to show that he relied on this means of silencing opposition. Whether he was driven to unfold the second part of his scheme earlier and more abruptly than he had designed, it is impossible to determine. The necessity came; the capitalists took fright; no more money was to be had; and there was nothing for it but to play his trump card at once.

The first thing to be done was to break the disagreeable news to the king. Louis had commenced his reign with a new-fangled eagerness to be a pattern sovereign. But the good seed lay on stony ground. His fat soul soon wearied of well-doing, and settled down to field-sports. To this animal Calonne now came with his awkward story. The impending catastrophe, he said, was not of his creating; Necker had bequeathed it to him; the famous *Compte Rendu* had been cooked; the deficit had been steadily growing since the days of Louis XIV; there was but one remedy—retrenchment. He then proceeded to sketch out a series of reforms of the most sweeping kind, some of them long demanded by enlightened men, others crude, and even whimsical, such as the payment of taxes in kind. The king gasped for breath. "Why," said he, "this is simply Necker over again." But he had not the manliness to send the impudent gambler about his business, and call to his counsels the only man who by special aptitude and deliberate conviction was entitled to preside over such a policy. Calonne persuaded him that there was no reason why that solemn disagreeable Necker should have a monopoly of reform and its credit, and obtained a pledge of the royal support.

The instrument by which the new reforms were to be carried out was worthy of the projector. Calonne was one of those statesmen who are cursed with ingenuity, that most fatal of all gifts in politics where breadth and simplicity can alone avail. The device of an Assembly of Notables seemed to him peculiarly happy. It was old. It was new. It was startling. It was safe. He could leer with one eye at the ardent champions of reform, while with the other he winked at the alarmed defenders of privilege. He would pack this Assembly by drawing half of it from that stratum of French society which, selfish as it was, had no speculative or sentimental prejudices, —atheist prelates scheming for promotion, and men of fashion, who petted Franklin, dined with D'Holbach, and laughed at the impudent hits of Beaumarchais. On their votes surely a reforming minister might reckon. The other half he would "educate" by assuring them that he was but developing the profoundest principles of the monarchy.

The Notables met, and Calonne hardily addressed himself to his

task with the air of a man certain of success. His first stroke was as maladroit as it was coarse. The opening sentence of his harangue informed the Notables that his plans were honoured by the personal approbation of Majesty. Unfortunately the sovereign was not venerated as a conclusive authority in politics, and even a packed Assembly thinks itself good for something else than registering a foregone conclusion. The financial statement was introduced by the minister with matchless audacity. He had studied economy; yes, economy; not, it was true, the niggardly petty cheese-paring, which some ministers had dignified by that name, but a large and liberal economy which consisted—in short which consisted in swelling the expenditure. But the dismay which the confession of the deficit excited gave place to a stronger feeling when the speaker went on with flippant pomposity to unfold his programme of reform. If he had any admirers left in the Assembly, gaping devotees who had believed to the last that their great medicine-man had some miraculous shift by which he would keep the game alive, here he parted company with them. It was in vain that he replied to attacks with infinite cleverness and assurance, and had a retort ready for every assailant. The Assembly, which he had himself devised and summoned into existence, turned upon him, and gave him plainly to understand that, whether his plans were good or bad, whether he was prepared to govern as a Reformer or a Conservative, go he must. Consistent, thorough-going partisans of privilege, such as Richelieu and Ségur, denounced him as a traitor for having convoked the Assembly at all; reformers would hear of no minister but the virtuous Necker; the sovereign, of whose personal support he had bragged, threw him over; and Calonne reluctantly bade farewell to office, leaving as the one substantial result of his administration that old landmarks and barriers had been recklessly beaten down by the accredited representative of privilege. The impossibility of letting things remain as they were, either in Church or State, had been officially proclaimed. In the struggle for place and popularity, all prominent men had recognised reform as a necessity; and however they might repent it, thenceforth there was for them no drawing back. For the people had heard words spoken which it would never again forget.

The fall of Calonne did not immediately realise the hopes of Necker. The court and the privileged classes were not yet prepared to see France ruled by an ex-banker, who did not even prefix the *de* to his name. Sixteen months of Brienne succeeded. Then there was an attempt to induce the great financier to coalesce with Brienne; in other words, to sell his talents and, what was worth more, his popularity to a clique of official hacks who loathed radical reform and would have thwarted him at every step. But it must be said for Necker that he had too much spirit for that. Though dying for office, he was ready

to wait a little longer rather than compromise his independence. His native vanity here rose into a proper pride. Laugh at him as we may, the man really did wish to do good, wished it ardently, and he was determined that when next he took office he would not be harnessed with a jibbing team. It was destined that he should not fail for want of his chance. The court surrendered at discretion, and Necker came into power triumphant, unfettered, the idol of the populace, with every qualification for governing except a strong character and some knowledge of his own intentions.

The great question of the day, the first which the new minister was called on to determine, was the constitution of the States-General which had been promised by the King, and were to meet the next year. Were the representatives of the Third Estate to be equal in number to each of the other two, or to both of them united? Were the three orders to sit in separate chambers or in one—to vote by order or by head? For simplifying finances, for a discriminating reduction or imposition of taxes, for a severe economy, for legislation tending to promote material prosperity, Necker was the very man. There he was on his own ground, and could tread firmly. But he was now confronted with political difficulties of another order, and his defects of mind and character became at once apparent. For his own part, he desired—so far as he knew what he desired—an Assembly which would support Necker. Sometimes he feared that the States-General would be too tame, too easily moulded by the privileged classes. At other times he was filled with nervous apprehension that it would hurry him into reforms of a nature and scope which he had never contemplated, and to the direction of which he felt himself as incompetent as he was disinclined. Being entirely without system in politics, he had no other guide for his action than public opinion. An English statesman now-a-days, who is similarly unprovided, can get along after a fashion without his nakedness being discovered, because a free press, free public meetings, and representative institutions afford a constant test of public opinion in all its variations. But in France, before the Revolution, public opinion had not organised itself; accurate gauges of it did not exist; and if they had existed, peeple were not yet trained to read them. The convocation of the States-General was a leap in the dark indeed. Poor Necker, peering around him for the straw to show how the wind blew, could think of no better way of feeling the public mind than calling together once more the selfish, impotent, and ridiculous Assembly devised by Calonne.

The Notables, as might have been foreseen, voted against the doubling of the Third Estate, against vote by head, against redistribution of constituencies. A cry of indignation went up from France. Addresses from municipalities and other corporate bodies poured in.

Necker had got his cue. It was with the King in Council that the real decision rested under the old régime. In the council, therefore, Necker set himself to calm the forebodings of privilege.[1] "Do not," he said, "be so jealous of this Third Estate; do not apprehend such terrible things from it. Look at its enthusiastic loyalty towards the present occupant of the throne; it will never think of attacking property or privilege—privilege being a property just as sacred as any other. I do not advocate the double representation because I want it to overbear the other orders by weight of numbers, which I should think very undesirable, but because such a concession to justice will satisfy public opinion. Once these inequalities adjusted, you will find that all three orders have much the same views about legislation. How should it be otherwise when good government is the manifest interest of all classes alike? Remember what weight the privileged classes will continue to have by their wealth and social prestige; besides there are so many subjects on which the deputies of the Third Estate can give us valuable information and advice; but if nothing else weighs with you" (and here Necker's loose sentiment bordered on true insight) "listen to the inarticulate voice of Europe everywhere joining in on the side of justice."

To publish a Report read at the Council of Ministers was an unheard-of proceeding. But with his usual restless itching for compliment, Necker rushed into print, and was thus at the pains to put on record for ever predictions destined to be so signally falsified by the event. For the moment, however, he tasted triumph. MM. de Nivernois, de Fourgueux, de Luzerne, de Saint Priest, de Villedeuil, de Montmorin—of such world-famous personages, in addition to Necker and good harmless old Malesherbes, was the Council of the King of France composed the year before the Revolution—were convinced or silenced, and the royal decree went forth, conceding the double representation of the Third Estate and redistribution of constituencies. As for the remaining and still more important question of voting by order or by head, Necker characteristically let it alone. He knew, everyone knew, that it would arise the first day the States met, that it would not settle itself, that the King would have to pronounce on it, that it would be wiser to pronounce at once than to wait till the orders had quarrelled about it before the eyes of France. Necker never moved in earnest till he had the maximum of force at his back. Moreover, he thought that the Third Estate had perhaps been sufficiently strengthened for his purpose; if not he had a weapon in reserve. In the meantime he tacitly allowed it to be inferred that he sympathised with the most liberal view, and he revelled in the sweets of a popularity to which there was no parallel in French history.

EDWARD SPENCER BEESLY.

(1) Rapport fait au Roi dans son Conseil.—*Œuvres de Necker*, vi. 432.

MR. ANTHONY TROLLOPE'S NOVELS.

WHAT is Mr. Trollope's rank as a novelist? Not estimated by the verdict passed on his stories, hot from the press, or by the demand at Mudie's? What will be said of his books twenty or thirty years hence? Which of them will be reprinted then, and read anew, and criticised anew, by a generation yet in its perambulators? The question is in itself a compliment. A very large proportion of modern novels—pleasant, even exciting to read, full of happy, suggestive writing, with characters natural and well painted, and ingeniously constructed plots—are forgotten in six months. We never think of re-reading them; and they are no more pieces of real literature than the exquisite new mantle sold by some Madame Hortense or other Parisian dressmaker is a work of art. The large and immediate circulation given to a successful story—the certainty that in a few months some new rival will push it from its stool—the high prices paid for anything that catches the public taste,—all tempt modern story writers to chime in with what they consider the fashion of the season. If plain governesses of strong mind and strange charm of manners are the fashion, the market is overrun with that description of heroine. If fair-haired murderesses are in demand, the supply will come up to it. A run on detectives finds the bookmakers equal to the emergency. If what are called domestic goods are called for, all the sentiment that lingers about slippers is gracefully evoked. If the public like to hear of matrimonial strife, we have a husband and wife who are married in the first chapter, and only get reconciled in the last through the intervention of a cherub child, which happily contrives to get born in some lucid interval of the intermittent storm that rages through the three volumes. Then for a time fickleness becomes a heroic virtue, and young men who jilt and young women who hesitate are the only characters that will go down. A list might be drawn up of novels in which the old-fashioned child-hero dies young of no particular disease; of novels in which the principal character is blind, deformed, or idiotic; in which the hero commits a murder, and is very sorry for it—these are many; in which the hero commits a murder and is not at all sorry—these are few: for novelists, as a rule, still cling to the idea—not certainly borne out by facts—that a man who commits a murder is ever after haunted by remorse—a superstition that it is useful perhaps to have generally believed. But it is well for us sometimes to fancy ourselves thirty-five years hence, oblivious of these fashions of the day, taking up a novel published this year or last year, and trying it by

the two standards—the high literature of all ages, and the human nature of all time.

It is sometimes asserted that beyond this we should value stories that give us true pictures of the manners of our time; and it is often said, "What a priceless value we should set on a novel of the period that would present before us the home and ordinary life of old Greece or Rome!" We hear, therefore, great eulogies of painters who cover square feet of canvas in painting a race-course, a railway station, or the sands of a watering-place, exactly as they exist, or of novelists who hit off the exact tone in which common-place gentlemen and common-place ladies make love in the reign of Victoria. We do not doubt the utility of these pictures and stories to an antiquarian a thousand years hence; the more realistic and the less artistic they are the better for his purpose; but as we do not live in that advanced period, as we are not in the position of our descendants, we hardly feel called upon to fall down and worship in a frame what we can see in real life and with as little true art at the Great Western Station, or to be entranced with the wonderful fidelity with which the style of Jones junior is hit off as he chats at his club or manages to convey to Miss Robinson his desire to make her his wife. If there were an Annual Register of manners and fashions, as well as of political facts, a place ought to be found in them for such mere copies and transcripts of common life; but they are no more art than the reflection in a mirror of the life of a London street; they are no more literature than a verbal report in the last breach of promise case of what the defendant said to the plaintiff's mother when "on the 14th of January he took tea at the plaintiff's house, and putting his arm round Lucy's waist, said he hoped soon to make her his wife:" a very thrilling situation for Lucy, but not unprecedented, nor very exciting to the bystanders, whether actually observed or faithfully reported in one volume, in two, or in three. We almost fear that many of Mr. Trollope's admirers think best of him because he manages to invest with interest such incidents of every-day life. We remember the many hours that have passed smoothly by as, with feet on the fender, we have followed heroine after heroine of his from the dawn of her love to its happy or disastrous close, and one is astounded at one's own ingratitude in writing a word against a succession of tales that "give delight and hurt not;" but we cannot help giving utterance to an opinion, perhaps utterly wrong, that to describe faithfully, even happily, how a "nice" English girl bears "nicely" a disappointment in marriage, is not in any sense at all a work of literary art. If we met in real life some man who, across the walnuts and the wine, told us truthfully the whole story of Lily Dale, we should say, "What a pity!" and "What a shame!" and "What is she like?" at the proper points; but we should consider

him rather a bore if the narrative lasted more than a quarter of an hour. It certainly is too slight to be made the subject of one novel or to be drawn out again and interwoven into a second.

But Mr. Trollope is certainly capable of better things, and in his "Last Chronicle of Barset" he has given us glimpses of a certain tragic and poetic power that place him far above any chronicler of young lady's thoughts. The story has all the good qualities of his other works—the exceeding naturalness of the dialogue, the homely fidelity to English character of the men and women, the absence of all coarse appeals to sympathy, the entire freedom from all straining after effect. But its superiority to his other stories arises from his selection of a situation as deep in its pain as any that could be brought within the range of ordinary English experience. We have a country curate miserably poor—that is common enough. He is placed in a parish mainly inhabited by a population less stolid perhaps than a purely agricultural peasantry, but whose better wages only induce greater surliness and a somewhat coarse independency. Then this curate is a man of fiercely intense piety and strong character, a ripe scholar, full of antique learning, but almost mad from the pressure of the daily, hourly, biting ills that come from household want. As a clergyman of the English Church he is brought into a kind of contact with the highest personages of the neighbourhood, and thus the peculiarities of his character become the public property of village gossips of all ranks. He is accused of having stolen a cheque; the facts tell against him; even his best friends fear that, driven wild by debts and duns, he may have committed the crime; and his wife, heroically patient and loving, half thinks that he must be mad when he cannot even tell her how he got it. This in itself is a striking situation. The depth of the man's anguish as he tries to realise that he—with his high conscientiousness, his ever-rigid preaching of duty, and his stern views of the holiness of a moral life—is held to be a thief; the awful dread of the wife that this last crowning calamity, her husband's public disgrace as a felon, is coming on, and that he is perhaps insane, present a combination of as keen an agony as is possible in ordinary English life. To these elements is added another that heightens and yet relieves the whole. The curate's daughter, a graceful girl,—drawn in slender outlines but with suggestive touches,—is loved by a gentleman of the county, who, before the cloud had come on the poor man's home, had almost declared himself. He hesitates for a moment, but is drawn on by circumstances and his love to act a chivalrous part, and his constancy—not heroically unflinching, but still natural and true—keeps, as it were, a bit of blue sky in the upper distance, even in the darkest part of the story; while the comparatively petty vexation of his father at the impending *mésalliance* is good foil, most artistically designed,

to the gaunt and deep agony in the other parsonage home. We do not remember any situation in any modern novel in which the pure tragedy of the circumstances is so deep; for it must be borne in mind that the sufferers are people made sensitive by early refinement and educated thought; that they cannot have even the solace of suffering in solitude, for the pain is a public event; and that because they are of the educated classes their sufferings come clearly home to our own conception and consciousness. Despite all the efforts of the greatest novelist of our days, the tragedy of Hetty Poyser's life does not touch us so nearly as the same sorrow in one of higher station. It is simply cant for educated men to pretend that their sentiments are as easily excited by the sorrows of people whose daily life and daily thoughts they can with difficulty realise, as by the sufferings of those who, on account of their nearness to us in social position, seem like ourselves, and whose sorrows we can understand and feel. Had Mr. Trollope devoted his genius to painting the same kind of shame and sorrow in the home of one of the brickmakers at Hogglestock,—the same half-insanity of a father, the same terrible anguish of a wife, and a similar cross in love to a brickmaker's daughter,—he would probably have failed in making a story that would live. There is pain enough, heaven knows, in the lives of the English poor; but pain cannot always be made into tragedy: if it could, the assize and police reports would, as they do not, furnish materials for works of art.

But granting to Mr. Trollope very high praise for the genius, the conscientious art, the happy power, with which he has designed and elaborated this story of the Crawleys, we do think that hardly any words can be too strong to express our annoyance at finding what might have been a perfect work of literature disfigured by chapters of utterly irrelevant matter. Because Miss Lily Dale was a jilted young lady in the "Small House at Allington," she must be trotted out again in this story as declining gracefully into the position of an old maid. Because Johnny Eames was a rather lubberly and lucky hobbledehoy in the one story, he must be Mr. John Eames in the second, still more lucky in the world, with *bonnes fortunes* in Bayswater, yet still besieging the impregnable Lily of his heart. We do not deny that, on the whole, Lily in her mature maidenhood is very natural, that she talks happily, that she is very like ten thousand other young English ladies of good style, and that faithful copies of John Eames are to be found by the score from ten to four in Somerset House; that half-silly women, like Mrs. Dobbs Broughton, with a substratum of the common-sense born of cowardice, are common enough; and that more than one Miss Demolines may inhabit handsome houses in the dissipated suburb of Bayswater. But why intrude those sketches of comedy and farce

—very fair, as far as they go—into what might have been a very finished story—an enduring piece of English literary art? Ten thousand years hence, if our literature lives so long, the tragedy at Mr. Crawley's hearth will be easily understood; his character will stand clearly out; but we might as well predict an immortality of art for the pictures in an illustrated paper as hope that Mr. John Eames or Miss Lily Dale will remain in literature as types of anything at all. If we had Mr. Trollope's leave, it seems that, with nothing but a knife, we could make his "Last Chronicle" one-half shorter and fifty-fold better worth preservation. We should simply cut out every chapter devoted to Miss Lily Dale, Mr. John Eames, Mr. Adolphus Crosbie, &c., &c., and make the story as it ought to have been, simply the tale of Mr. Crawley's trouble; how it affected himself, his wife, his daughter, his daughter's lover, his daughter's lover's father, his bishop, and his bishop's wife. With the one finely pathetic figure as the centre, a perfect story could be thus built up. It might have been beautifully told in one volume; but Mr. Trollope, seduced by his publisher, his popularity, or by a weak wish to wind up a crowd of characters in previous novels, introduces personages who are hooked on to the tale without reason, relevancy, or excuse. Even old Mr. Harding—excellently drawn in "The Warden"—is dragged in to be slowly and gently put to death; a most inartistic diversion of the interest that attaches to the central and proper pathos of the tale.

But when we had cut out the portions now horribly interleaved, we should take up the remaining pages, rebind them tenderly, not losing one, and treasure them as a very finished work of English fiction; in fact, fully deserving of the title—the very high title—of a work of literary art. The key-note of the situation and of the great character of the book is struck in some of the opening words:—

"It seemed to her [Mrs. Crawley] that she would be compelled to have him proved to be either a thief or a madman. And yet she knew that he was neither. That he was not a thief was as clear to her as the sun at noonday. Could she have lain on the man's bosom for twenty years and not yet have learned the secrets of the heart beneath? The whole mind of the man was, as she told herself, within her grasp. He might have taken the twenty pounds, he might have taken it and spent it though it was not his own; but yet he was no thief. Nor was he a madman. No man more sane in preaching the gospel of his Lord, in making intelligible to the ignorant the promises of his Saviour, ever got into a parish pulpit, or taught in a parish school. The intellect of the man was as clear as running water in all things not appertaining to his daily life and its difficulties. He could be logical with a vengeance—so logical as to cause infinite trouble to his wife, who, with all her good sense, was not logical. And he had Greek at his fingers ends—as his daughter very well knew. And even to this day he would sometimes recite to them English poetry, lines after lines, stanzas upon stanzas, in a sweet, low, melancholy voice, on long winter evenings, when occasionally the burden of his troubles would be lighter to him

than was usual. Books in Latin and in French he read with as much ease as in English, and took delight in such as came to him, when he would condescend to accept such loans from the deanery. And there was at times a lightness of heart about the man. In the course of last winter he had translated into Greek irregular verse the very noble ballad of Lord Bateman, maintaining the rhythm and the rhyme, and had repeated it with uncouth glee till his daughter knew it all by heart."

It is impossible not to be reminded by this of Parson Adams—also learned, also poor. In Mr. Crawley we have a new Parson Adams, with the self-consciousness natural to the modern man, and yet with the occasional abstraction which is an essential part, also, of the character of Fielding's hero. We have, too, in Crawley the priestly teacher more prominent, while in Adams it is almost entirely in the background. Then Adams is almost always mixed up with comedy, while Crawley is the centre of a drama, with the possibility of a tragic end. In the Vicar of Wakefield we have another parson, but the drama there is melo-dramatic, and the whole story throughout, even when it comes nearest to deep emotion, still is somehow redolent more of comedy than of tragedy; for instance, the turn of events by which Olivia is "restored to virtue," by the discovery that her marriage was after all valid, belongs more to the last scene of a Haymarket play than to a story, tragic or otherwise, of real life. In Crawley and the Crawley household we have a poverty that is picturesque in its intensity and completeness, but never low or mean; for the carpetless room re-echoes to the sonorous recital of Greek verse, and Crawley himself never forgets that he is one of God's priests. Even the young girl, Grace Crawley, takes a natural dignity from the fact that, as her father's favourite pupil, she is a good scholar—though sweet and girlish, as love takes up for her the harp of life and gives her new music, and as a terrible shadow comes to blot out the sunshine. There is art in Mr. Trollope's not introducing us to the girl until she is loved. Grace Crawley, unwooed by Major Grantly, could not help taking a certain tone from her domestic surroundings—must have acquired, perhaps, hardness, bitterness, or singularity from her unusual education and peculiar, not to say odd, bringing up. But Grace Crawley loved, is humanised; and Grace Crawley with her love clouded, is softened; we forget the Greek, the poor or borrowed clothes, as we think of the possibilities of her life, as they seem to her young imaginings,—of the Fairy Prince who can lift her to his high estate. Indeed Mr. Trollope himself supplies us with means to judge what Grace might have been before her lover came to glorify her life. In the very few words spoken by the younger sister, Jane Crawley, we have all the abruptness and angularity of a young girl not much used to society, unusually educated, still too young either to be loved or feel the need of it; not unhappy even in the poor home,

because she also is her father's pupil, the companion of his studies, and the sharer of his loftiest thoughts; we see in her what Grace was; we see in Grace what the change from girlhood to womanhood, from mere home-life to a life filled up by love, can accomplish and effect. It will be noticed, if we analyse the story thoroughly, that the main element is tragic: a terrible woe hanging over the head of the wretched home, with the possibility of the deeper sorrow of actual insanity—a fear present to him and present to his wife. But the tragedy is relieved, in the first place, by the dignity of the man as a scholar and a priest; secondly, by the excitement of the conflict between him and the bishop; and, thirdly, by all the happy possibilities arising from Major Grantly's love for the daughter of the house. Thus light and shade are naturally intermixed. The strangeness to us is, that a novelist who could so well design a tale so thoroughly good—and should have carried out his design even in the minor characters and small bits of dialogue so well—should have spoiled it by binding it up in the same volume with records of the flirtations of Conway Dalrymple and Johnny Eames, with Mr. Toogood's good-natured vulgarism, and Mr. Dobbs Broughton's tipsy rage. There is, we suppose, no Court of Revision that could compel Mr. Trollope to rewrite his work. It is difficult to speak too highly of the simplicity of the pathos in the well-known scene where Mr. Crawley refuses to receive Major Grantly's proposal, the perfect fidelity to nature, the artistic avoidance of all irrelevancy or exaggeration. Every word tells, and, though the feelings are highly wrought, nothing is strained; and every one of the actors is English and human throughout. It would be easy to refer to twenty other passages equally good; to point out with what fine touches Archdeacon Grantly is drawn; how the almost comic domestic despotism of Mrs. Proudie is suddenly lifted into something like tragedy by her sudden death; but room is wanting for this kind of criticism in detail.

Of all the other novels of Mr. Trollope's we think "The Warden" comes next to the "Last Chronicle" in touches of pathos and power. That was the first chronicle of Barchester, and there is a freshness in it that hardly belongs to the rest, until Mr. Trollope set his hand to conclude his records of life in a cathedral town. In one respect it is superior to the story of the Crawleys: it is not disfigured by irrelevant matter. Mr. Harding remains the central figure throughout, and we doubt whether there is a chapter that could be entirely taken away without affecting the intelligibility of the story. *That*, it seems, to us, ought to be, at least, one test of a story as a work of art.

But to expect English novels to be works of art is asking a great deal, when we consider what they are. We are rather omnivorous in our taste, for we do not sneer at Miss Braddon, we are thrilled

by Mr. Lefanu, we delight in Mr. Dickens, and tolerate nearly all his imitators; we reverence Thackeray, and we—read what his copyists put forth; we are profoundly thankful to Mr. Trollope for many hours of happy interest; whilst there are a nameless host of minor writers who put into single stories much power, sometimes great pathos, often keen observance of life. But when we think of the novels we have read for twenty years, that there are issued every year, and unread by us, scores of novels "that we have heard others praise, and that highly;" and when we think that not perhaps two per cent. even of these good novels will be read this day twenty years, we are struck with the wondrous waste of power. Every man who reads novels with any thought of the process of their construction must remember how often he has read stories that could have been made works of art by a little more trouble, some knowledge of the true principles of literary art, some desire to give unity, purpose, and truth to the story as a whole. The story-telling art is, on the whole, rare and peculiar. Some of the best critics are utterly destitute of it, and men and women who have little literary, and no artistic power, sometimes distinctly possess it. It would be easy to name story after story in English fiction containing characters, chapters, passages, full of life, truth, pathos, humour, or power, yet almost worthless, as a whole, from excessive dilution of the story—a frequent fault—or awkward management of the plot, or irrelevancy, or introduction of needless characters, or impertinency of whole pages of sentiment, destined to be skipped. In fact, if we survey the English literature of fiction, we find that our men of greatest genius, as story-tellers, take a perverse pride in disdaining those ideas of unity, simplicity, and chastity in art which animate even very inferior French writers. Mr. Dickens seems to revel in his rich mastery of humour, in his power of conceiving and painting the grotesque, in his capacity—very like that of Doré—for throwing a wild and weird light over inanimate nature. In the main, he is content with these gifts, and sets at defiance all literary law. No doubt some of his stories are carefully built up; but with the care that some man, his own architect, devotes to a house for himself—erected without regard to any order of architecture but his own. Now, "as leaves, wood, and branches, clapped hodge-podge together don't make up a tree," so three or four striking characters, splendidly painted, two or three grotesque creatures, four or five grand scenes, some sixty or seventy incidents, a mystery, and two or three lay figures, do not constitute a story as a work of art, even if there is humour or sentiment in almost every page. One of Mr. Dickens's stories—not the most happy in other respects, and in part marred by a straining after effect—the "Tale of Two Cities," seems to me more successfully constructed than any of his, as a work of art in fiction—

built up with care, from the first chapter to the last, and with considerable success. Of Thackeray, as a writer of genius, few men can speak without reverence: but his incurable habit of stopping his stories that he may preach is simply fatal to all recognition of them as works of art. What should we think if Hogarth put little tickets on his pictures with "Observe the weakness of human nature in this rake," or "Note the good feeling of the poor harlot"? And yet that is what Thackeray does in almost every chapter—as if the *Punch* essayist—full of fine dry satire, quiet wit, happy tolerance, and nice humour—was too strong for the constructor of stories, and so betrayed the old vein throughout everything he wrote.

In one respect Mr. Trollope deserves praise that even Dickens and Thackeray do not deserve. Many of his stories are more true throughout to that unity of design, that harmony of tone and colour, which are essential to works of art. In one of his Irish stories, "The Kellys and the O'Kellys," the whole is steeped in Irish atmosphere; the key-note is admirably kept throughout; there is nothing irrelevant, nothing that takes the reader out of the charmed circle of the involved and slowly unwound bead-roll of incidents. We say nothing as to the other merits of the story—its truth to life, the excellence of the dialogue, the naturalness of the characters—for Mr. Trollope has these merits nearly always at his command. He has a true artist's idea of tone, of colour, of harmony; his pictures are one; are seldom out of drawing; he never strains after effect; is fidelity itself in expressing English life; is never guilty of caricature. Why then are many of his stories, with all their merits, not enduring works of art? Simply, in our opinion, because his choice of subjects is utterly wrong. The genteel public of the day may demand portraits of themselves as they demand photographs of surly-looking men and simpering women, which they call likenesses of themselves and their wives; but no amount of skill can make common-place men and common-place incidents and common-place feelings fit subjects of high or true literary art. Phidias himself, set to carve in marble portraits of London aldermen, could not give the busts any heroic air, or any endurance as the best works of art. Mr. Trollope paints with perfect truth the young girl of the present day, and the young man of the period; he also manages to make us interested, while we read, in their sayings and doings; but the manners, the ideas, the love are of the day, and we doubt whether they can live. Why should they live? What is there in the story of Lucy Robarts that makes it a story of human nature as well as of English-young-lady life? She meets a young lord, is loved, loves him, but conceals and denies her love because she thinks his family too grand to be entered into unless they come down from their height to ask her to come up. This is, perhaps, natural enough. We know that in English rural

life there does exist a sense of aristocracy, which takes the form of resenting supposed airs; the men or women who don't cringe are apt to snarl; and to treat a lord as another man—neither to be servile nor surly, is often beyond English power. A young lady who thinks it heroic to be unnaturally stiff to a titled mother-in-law *in futuro*, may be the natural subject of a pleasant story illustrative of the manners and customs of the English of to-day, but cannot be the central figure in a story destined to endure as a work of art. The difference between nature and art, as Lord Lytton has well indicated in one of his best essays, is that "in nature is a something purely individual and particular. Art, on the contrary, is essentially destined to manifest the general . . . . to represent under sensible forms the free development of life, and especially of mind." Lucy Robarts, in Mr. Trollope's pages, is the parson's sister of the present day—as essentially of the present day as her picture in the illustration "Is it a lie?" by Mr. Millais stamps her as having lived when crinolines were worn very large. That kind of young lady is passing away. The parson's sister twenty years hence will not be like her, and, fifty, or a hundred years hence, our grandchildren and great-grandchildren will require our certificates to make them believe that she is true to our time. It may be said that Squire Western, Parson Adams, and Parson Trulliber are also "of the time," and represent only the coarseness of an epoch; but there is in them, beyond the manners of the period, very deep touches of the human nature of all times, which will make them live for ever as types of general humanity, though dressed in the peculiar costume of their own day. The same can be said of Crawley, and of Bishop Proudie, and the other essential characters in the Crawley tale; but of the other and many characters that Mr. Trollope has drawn in his other novels, how many live as realities in our mind? how many will be referred to thirty years hence as alive, if we may so speak of the characters in fiction that will live on for ever?

We have known it objected to Mr. Trollope that he only paints respectable people; that he understands only the sorrows of people who "keep a gig." We think that the story of Crawley goes a great way to refute this charge; but our indictment against him would take another form. He knows more, we think, of English parson life than any man in England. He has somehow got behind the clerical waistcoat, and can count its throbs: can he not, then, tell us something deeper and something more than he has yet done? We accept his revelation of Crawley struggling with poverty and shame, of Mark Robarts fighting off debt; but has he never heard of any conflict deeper, higher, fiercer, worse? We know how the English clergy appear to many. They are country gentlemen, who always wear white neck-ties and never swear; they are a kind

of better behaved squires, who don't drink much, and who read the Bible. But if that fairly described the majority twenty years hence, it does not now. A new life has come into the Church. Many are discontented at the anomalies of their position; the Erastianised, sleepy, squirearchical, port-drinking, of the earth, earthy, incumbent is often succeeded by some man who believes that he has a divine mission, who speaks as one having authority, who fights with apathy and sin and the devil much more like a Methodist of the last century than the rector or vicar of the past generation. Now the conflict of ideas between such a new man and the parishioners accustomed to the old rector and his old ways, is just what no newspaper or history can ever give us; but which an able, observant novelist like Mr. Trollope, knowing the clergy by heart, could admirably describe. Surely in this sharp almost tragic contrast there is something higher, nobler, for a novelist that the pecuniary embarrassments of worldly parsons, or their relations with squires, bishops, and bishops' wives.

Then, again, we admit Mr. Trollope's power in describing young ladies in love and in doubt. He knows English girls by heart. We cannot well fancy him a Sylph like one of Pope's in the "Rape of the Lock," else we should suppose that he had often listened to a thousand talkee-talkee conversations, when young ladies in the seclusion of their bed-rooms or dressing-rooms unloose their thoughts to one another, and let down their back hair. But surely English ladies suffer occasionally other agony than doubts as to whether this or that lover is to be the man thrown over, accepted, snubbed, encouraged, or drawn on. We say not a word against love in stories: save "Caleb Williams," there is no good English story without it. But there are deep chords in woman's nature that this kind of love does not touch; and as the prose laureate of English girls of the better class, why should not Mr. Trollope record something else beside flirtations that end well? Lady Glencora Palliser is pretty and true gliding over thin ice with her handsome lover; pretty and true in her candour to her cold spouse; pretty and true with her baby heir to the great dukedom. But suppose she had run away? Is there nothing deep, dark, and deadly in human nature and human sin to be painted vividly so that our souls may be purged by terror, and pity, and stronger thoughts than amusement at unmarried jilts, married flirts, and young mothers?

J. Herbert Stack.

SCHUBERT.[1]

To the vast multitude to whom is denied the endowment of genius, there are few books more fruitful in consolation than the lives of great musicians. The gift of writing good music is one of the most unprofitable of possessions, and it is too frequently accompanied with peculiarities of physical temperament which are the reverse of conducive to long life and happiness. To the great musical composer, above all other men, is applicable the old saying, "Omnes ingeniosos melancholicos esse." There are exceptions, and very striking exceptions, to the ordinary rule. But they are too rare to overthrow the rule itself. To the fact that the composition of music of a higher order is one of the worst possible means for obtaining a livelihood, there are scarcely any exceptions at all. Rossini used to declare that it was utterly impossible, even for the popular opera writer, to make such an income by his works as would allow him to live comfortably and lay by something from his savings; and if this was Rossini's experience, what must naturally have been the fate of those who were greater than he, and who wrote for far more scanty and less wealthy audiences? Handel, it is true, left a handsome fortune behind him; but, like Shakspeare, he earned it as a theatrical manager. Sebastian Bach earned a very modest competency as a teacher and organist, but the sale of his wonderful works would not have kept him in bread, even without the cheese. Mozart and Beethoven barely drove the wolf from the door; and Mendelssohn, happily for himself, was the son of a tolerably wealthy father.

But of all sad and dreary records of the struggles of a man of rare endowments with something very like penury, the history of Schubert's life is the saddest and most dreary. Certain personal peculiarities undoubtedly stood in his way in his occasional efforts to obtain some permanent post, which would at least have saved him from a dependence upon the sale of his writings for his daily bread. But apart from all such hindrances to success, the one fact stands out in miserable prominence, that the majority of his works were wholly unsaleable, and that from those which were most popular he failed to gain more than a wretched pittance. More keenly than any other of the great masters of his art, he was made to realise the inevitable truth, that while painters, sculptors, and architects can often live as gentlemen, and not seldom can heap up large fortunes,

(1) The Life of Franz Schubert. Translated from the German of Kreissle von Hellborn, by Arthur Duke Coleridge, M.A., late Fellow of King's College, Cambridge. With an Appendix by George Grove, Esq. London: Longmans. 21s.

the musician who is gifted with genius writes for others' gain. Singers, players, and opera-lessees fare sumptuously upon his works; and his own portion is not very much more than the crumbs which fall from their well-spread tables.

On the other side of the account, it is commonly supposed that the possession of musical genius, and the mere act of composition, with its bright hopes and pleasant memories, are things so sweet and satisfying in their nature, that after all it must be a very happy lot to be a Mozart, a Beethoven, a Schubert, or a Mendelssohn. Playing over or listening to their wonderful inspirations, it is difficult, indeed, to believe that the simple production of melodies and harmonies from which we ourselves derive such exquisite sensations of delight was not a source of untold and unmixed enjoyment to those who poured them forth. If we can feel, with emotions that to a non-musical listener seem extravagantly unreal, the truth, the beauty, the tenderness, and the joy of a masterpiece of music, surely, we assume, the power of creating these magical sounds must have ensured no small amount of happiness to the musician who was inspired with them. I venture, however, very much to doubt whether it is so. Undoubtedly, the simple act of the composition of good music is an enjoyment of a high order. It is of the same kind as the successful exertion of any other sort of intellectual energy. The mere employment of the faculties with vigour is in itself a pleasure to every healthy mind; and the expression of one's own best thoughts in prose, or in verse, or upon canvas, or in marble, is one of the keenest of the enjoyments of which our struggling nature is capable. A man then feels that he lives, with an intensity that can be realised by no other means. But as all these modes of exerting the creative faculty are rarely unaccompanied with elements of trouble which make the very act itself a pain, so it is pre-eminently in the case of musical creation. "I am never merry when I hear sweet music," is a saying echoed by almost every listener who has the truly hearing ear; and the very same sadness more or less accompanies the giving birth to any music which is capable of profoundly touching the soul. There is very little music of the highest kind which is not tinged with an inexpressible hue of sadness. Even with Handel and Bach it is only occasionally that they appear unconscious of the unfailing sorrow of human life. In Mozart's brightest moments his laughter seems to be on the verge of melting into tears. Beethoven is for ever expressing the thoughts of a heart that, whatever be the occupation of the hour, is always aching. Haydn is bright, but he is not profound. It is, therefore, because great musical genius is usually accompanied with that peculiar temperament which predisposes to sadness, and because the traces of this depression are rarely absent from the works of the greatest

masters, that I conclude that we who sit at their feet and listen derive more enjoyment from their inspiration than they themselves derived even from their happiest moments.

And of all their biographies, the life of Schubert is that which ought to teach content to mediocrity. It is impossible to doubt that it is a much pleasanter thing to us to hear and sing and play his music than it was to him to create it. His songs, in all their marvellous variety, are often nothing less than one unceasing rhythm of pathos and complaint. Not of unhealthy complaint, it is most true; for, pathetic as Schubert is, he is never morbid. But whatever he writes, there is still present the deep, under-song of human suffering, and a consciousness of the vanity of all human joys. It is the complaint of the nightingale as contrasted with the exuberant happiness of the lark. "My productions in music," he wrote in his diary, "are the product of the understanding, and spring from my sorrow; those only which are the product of pain seem to please the great world most." And everywhere in the other fragments of this diary, which Dr. Hellborn has preserved, the same sentiment of inexpressible sadness is constantly breaking out. "No one fathoms another's grief; no one another's joy. People think that they are ever going to one another, and they only go near another." This last sentence adds a force to the Wise Man's famous saying on the loneliness of man, which confirms that impression of the vigour of Schubert's understanding and the intensity of his self-inspection which his songs so powerfully suggest. "Grief," he says again, "sharpens the understanding and strengthens the soul; whereas joy seldom troubles itself about the former, and makes the latter either effeminate or frivolous." At an earlier date we find similar indications of his habitual way of interpreting the realities of life in just the same spirit. "Man bears misfortune uncomplainingly; and for that very reason feels it all the more acutely. For what purpose did God create in us these keen sympathies? Light mind, light heart; a mind that is too light generally harbours a heart that is too heavy. Town politeness is a powerful hindrance to men's integrity in dealing with one another. The greatest misery of the wise man and the greatest happiness of the fool is based on conventionalism."

Schubert's whole personal history and his music were, in truth, the result of one and the same combination of gifts, defects, and untoward circumstances. Of the general tone of his innumerable instrumental works it is, indeed, somewhat hazardous to say anything without much hesitation. They are so little known in England, and, in fact, so little known anywhere, that it is possible that a familiarity with all his nine symphonies and his other great compositions, which are rarely heard, might reverse or modify the opinion that they, too,

express the conflicts of a mind which was bitterly conscious of the failure of all human hopes, and unable to enforce upon itself a course of harmonious existence. But, so far as I can judge of them, the boundless varieties of melody, sweet and pure, which flowed from Schubert's pen like water from a fountain, are in all his writings incessantly intermingled with certain outbursts of sadness; and he seems to be ever expressing efforts at self-mastery, but rarely crowned with success. And this is a most important thing to be remembered in any attempt at a thoroughly critical estimate of his capacity to write instrumental works upon the largest scale. As far, indeed, as I can understand Dr. Hellborn's own opinion, it coincides with the view of those who hold that Schubert's longer compositions are deficient in unity and development. They abound in beauties of every kind, and the orchestral treatment is as delicate as rich, and as appropriate as it is original. And, moreover, whatever were the influences of Beethoven upon Schubert, who was his enthusiastic worshipper, the individuality of the worshipper was never for an instant obscured or injured.

On the supposition, then, that this opinion is in the main correct, two interesting questions arise: How is the existence of the defect to be accounted for in a mind so wonderfully gifted with melody and with so true a feeling for form? and, if Schubert had lived to maturer years, is it probable that the supposed deficiency would have disappeared? To those who think that the fault was irremediable, I would offer the following suggestions, as tending to prove that Schubert really died in the immaturity of his powers. In the first place, it is incredible that one who possessed the gift of form in so perfect a degree when treating subjects on a small scale should be really incapable of achieving the loftiest exploits of unity and development, provided only that his understanding was vigorous, his gift of melody manly and powerful, as well as pure, and his capacity for working equal to the strain upon his imagination. Now it is undeniable that Schubert's feeling for unity of idea and its progressive development within small limits was absolutely perfect. He wrote "The Erl-King" when he was eighteen. Can any dramatic song be named in which unity of idea and easy development are more conspicuous? Or to name the first half-dozen of his songs best known to English singers which occur to me: "The Serenade," "The Praise of Tears," "The Postman's Horn," "The Barcarole" ("Mitten im Schimmer"), "The Trout," and the series called "Die schöne Müllerinn"—here are songs, totally unlike one another, except in the fact that nobody but Schubert could have written them. The melodies are all lovely, the accompaniments are all original, every note is vigorously expressive of some shade of human emotion. There is not a mawkish or washy chord or

sequence among them all; and withal they are every one of them little poems of the most highly elaborated cast. Yet this astonishing man wrote his songs off at railway speed, their ideas rushing upon his brain in perfect completeness. I can hardly imagine a more convincing proof that Schubert had within him "the root of the matter" for writing symphonies as complete in technical structure as the symphonies of Mozart and the fugues of Bach, and as perfect in emotional unity as the symphonies and sonatas of Beethoven.

The slowness with which this gift was matured in Schubert I attribute partly to his character, his general education, and his position in society, and partly to his musical education. He was a shy, modest man, with little ambition, resting on a basis of obstinacy and a too early acquaintance with the insensibility of the multitude to great ideas and high aspirations. He laboured from the first under the serious disadvantage of being cut off from familiar intercourse with men his own equals in natural gifts, both musical and otherwise. Born of the humble family of a schoolmaster of the Austrian poor, his education was slight; while during his residence in a seminary for the training of young musicians, he shirked all general studies, as far as possible, in order that he might indulge his already vehement passion for composition. For about three years he toiled miserably as an assistant to his father's school; and when the time was over, he was thrown on his own musical resources for his living. Thus his mind was left to grow in its own vigorous, wayward fashion, with none of that healthy discipline which severe study and the society of intellectual equals and superiors would have imposed upon an impulsive nature. That idea of grandeur, self-command, forethought, and a deliberate choice of means to an end, which is of the very essence of moral and intellectual greatness, was never set before him or presented for his cultivation, while it is precisely in its expression of this ideal that a symphony of the highest order differs from a mere song, or from a collection of beautiful fragments. Thus uncultured, and yet yearning for the sympathy of others, Schubert flung himself into the society of miscellaneous people, some degrees above the class in which he was born, but by no means sufficiently so to raise the standard of his self-respect, and to teach him a rigorous self-discipline. When not pouring forth some song, or opera, or mass, or symphony, or dance music, or chamber music, he loved to recreate himself with a few clever, jovial, free-and-easy fellows, better educated, but naturally less gifted than himself; and with them he enjoyed himself after his fashion, the fashion now and then including the drinking more wine than his excitable head could bear, and doubtless tending to cause the severe headaches from which, after a time, he suffered so heavily. Occa-

sionally he met with openings for mixing with families who could have aided him in the world, and by whom he was much liked. Thus he passed two summers with a branch of the Esterhazys in their country house, and gave them lessons in music; on the first occasion taking it into his head to fall in love with one of the ladies of the family, though, as far as appears, he had the good sense to keep his excited feelings to himself. All this, of course, while it helped to strengthen the emotional part of his nature, failed to open his mind to that ideal intellectual grandeur which finds its musical embodiments in the symphonies and sonatas, the fugues and the choruses of the greatest masters. As he himself implies in his diary, he learnt music through his inner sufferings. With all his jollity, his heart ached, and forced him to open his eyes to the beauty of that greatness which can only be attained by toil and suffering and many disappointments.

Schubert's musical training was also of that description which failed to cultivate the latent greatness of his powers. At the Vienese seminary his musical studies were of the more elementary kind; in fact, he outran them almost before they were begun. Salieri, the only one of his teachers who is known to fame, was an adherent of the traditions of the Italian school, and did not appreciate the intense romanticism of Schubert's genius. What the young composer wanted was the steady study of the great masters of counterpoint, from Palestrina to Bach, Handel, and Mozart. He loved Mozart with all his soul, but it is evideut that it was Mozart's melodies rather than his constructive skill and breadth of style which he appreciated. Counterpoint did not come naturally to Schubert, though of course he learnt it, and could write canons by the dozen or the score; while it was only by the cultivation of a love for the fugue and its modifications that he could have controlled the exuberance of his melodic gift, and marshalled his ideas into array on the grandest of scales. Of all the great masters, Beethoven alone wrought out his developments and climaxes apart from an essentially fugal treatment; and his works were not a safe model for an impulsive mind, overflowing with richly-harmonised tunes, like that of Schubert. The unity of Beethoven's writings is the result of an intensity of emotion pervading the most startling transitions of mere form with an unbroken identity. Those who once feel with him and understand his language find it the most natural and simple of tongues; while to others, his later works are fragmentary and incomprehensible to the last degree. To compose therefore on a grand scale, on Beethoven's system, one must be a Beethoven; and that Schubert was not. I see in him far more of the Mozart nature than of the Beethoven nature; only, unfor-

tunately, counterpoint was not born within him, as it was in the author of the Jupiter Symphony and the Requiem.

Had Schubert lived, then, instead of dying at the age of thirty-one, it may be fairly concluded that he would have achieved orchestral works as perfect in their way as his songs. And those songs were more than six hundred in number, of which about three hundred and sixty have been published. When he died he had actually written nine symphonies, nearly all completed; and in an entertaining addition to Dr. Hellborn's valuable memoir, Mr. Grove enthusiastically records his expedition to Vienna in search of the MS. scores in the possession of Dr. Schneider. Of nearly all these symphonies Schubert himself never heard a note performed; and, though the Crystal Palace band, under Mr. Manns, has already taught the world what a mine of wealth lies yet undiscovered by English lovers of music, Schubert is still, to a great extent, an unknown composer. And what is wanted is, not merely the occasional performance of his MS. works, but the publication of good pianoforte arrangements of his symphonies and other orchestral music for a single player.[1] Thus only can the multitude of professional and amateur musicians familiarise themselves with the peculiarities and beauties of his style, so as thoroughly to understand him when they are so fortunate as to hear his compositions played under the direction of a conductor like Mr. Manns.

As has been said, Schubert lived and died a poor man. He could not get his "Erl-King" published until four years after it was written. The vast majority of his works never brought him a single florin; and publishers are not to be blamed for declining to print music that nobody would buy. He could not endure teaching, and speedily gave it up. His operas failed when brought upon the stage. For most appointments he was utterly unfit, as he abhorred every restraint that fettered his freedom of action. Melancholy, therefore, as is, on the whole, the story of Schubert's life, I do not see how it could have been otherwise, considering that the mass of mankind care nothing for classical music, and that he would not submit to that routine of dull work by which we most of us have to earn a living. Nature might have made him the heir to a competency, or to a dukedom, if she had pleased. But as she made him the son of a humble schoolmaster, she predestined him to a life of struggle and to a posthumous fame.

J. M. Capes.

(1) The only Pianoforte arrangements of the Symphonies which, I believe, now exist, are those for four hands of the C major Symphony; and for a solo player, and also for four hands, of the Symphony in B. The *Rosamunde* music is arranged both as a solo piece and as a duet.

SUEZ CANAL.[1]

PART II.

On leaving Port-Saïd the canal at once enters Lake Menzaleh, through which the channel runs for a distance of 29 miles. This lake much resembles Lake Mœris, which is seen by the railway traveller soon after leaving Alexandria. The waters of Lake Menzaleh are shallow, and the bottom is composed of mud, deposited by the Pelusiac and Tanitic branches of the Nile, both of which flow through this lake. At times the sea also washes over the low strip of sand fronting the northern shore of the lake. It was at first anticipated that there would be much difficulty in keeping the channel from becoming choked by the mud from the surrounding lake; but as the work progressed, it was ascertained that this stratum was superficial only, and that below it there lay a firm argillaceous soil. It was at first considered that this portion of the channel presented the greatest difficulties as regarded its future maintenance in a navigable condition. More than a year ago the contractors completed a length of about two miles, at the point where the line of the canal intercepted the course of the Pelusiac branch of the Nile. Here neither the embankments nor the bottom of the canal have hitherto lost their original shape and proportions. The dredgings have been employed throughout this portion of the channel to form the embankments. This is accomplished by means of the powerful machinery now in use; and each day, as these embankments are raised, they become more firmly consolidated. Leaving Lake Menzaleh at Kantara, a station on the desert route between Egypt and Syria, situated at its southern extremity, the course of the canal for 2 miles lies through low sand hills, where it enters Lake Ballah, a lake similar in character to Lake Menzaleh. This it also traverses for a distance of 8 miles, and then enters a deep cutting, extending from El Ferdane to Lake Timsah. Near El Guisir,[2] which lies about 4 miles south of El Ferdane, the deepest cutting throughout the whole line of the canal had to be excavated, varying from 60 to 70 feet. This was accomplished by means of three lines of tramway, by which the excavated soil was carried away, six large engines and 250 waggons being employed for the purpose. M. Couvreux, who held the contract for this section, succeeded in accomplishing it in January, 1868, six months under contract time.

(1) Continued from p. 100 of the Fortnightly Review for January.
(2) Pronounced Eb Girch.

In 1859, when the Company still retained the contingent of 20,000 *fellahs*, the greater part of them were here employed in forming a narrow channel to enable the dredges to be floated in and utilised.

In two years the channel for the dredges was completed, and the waters of the Mediterranean flowed into the vast basin of Lake Timsah, the filling of which occupied five months.

As it was here the *fellahs* were for the most part at work in the early part of the enterprise, it will be as well to say a few words regarding the description of labour now employed by the Company. Most of the workmen are again *les indigènes*, but coming now as volunteers, and attracted by the good and certain wages which they can earn. The greater part of the excavation is accomplished by piece-work, from which excellent results are obtained. The engineers measure the quantity of earth to be removed, and name the price that will be paid for the work, making due allowance for the nature of the soil, and the distance it has to be transported. All requisite implements are provided by the Company. The price is such as enables the labourer to earn from 1*s.* 6*d.* to 2*s.* 6*d.* a day; but, usually, he manages to make more than the minimum sum, and generally has completed his task before the stipulated time. Gangs are formed, as much as possible, of men of the same nationality. The prospect of speedy remuneration acts as a powerful incentive to zealous labour. The indolence of any one member of the gang would cause confusion and delay in the regular circulation of the tram-waggons and carts; the men, therefore, take good care that all the members of the gang perform their fair share of the allotted task. At first there was some difficulty in getting the *indigènes* to use the wheel-barrow; so much so, that some commenced by carrying them on their heads. They were in the habit of using either a small basket, holding only a few handfuls of earth; or one shovelled it into a sack, whilst another carried it away. As for their nightly accommodation, the *indigènes* are easily satisfied. They procure two planks, which they place on the ground in the form of the letter A. Wrapped in their blanket, they creep into this triangular space, and thus make out the night quite to their satisfaction. The French have, not inappropriately, given these primitive abodes the name of "*bonnet de police*," which, in shape, they exactly resemble. Manual labour is employed where the working level is above the reach of the dredges, or in such portions where the work is being carried on *à sec*, that is, either by manual labour, below the future water-level, or by any other process of excavating, without the assistance of floating dredges.

The inland lake of Timsah, which, heretofore, at the seasons of the inundation of the Nile, occasionally received some water from a

branch of that river, is now transformed into a Mediterranean lake, nine miles in circumference. The water which was required to fill this depression of Timsah was about 95,000,000 cubic yards, and the depth is such as to require but little dredging for the channel of the canal through the lake. It is thus the Company have formed their third and inland port. On the north bank of the lake stands Ismaïlia (named after Ishmaïl Pacha), a flourishing French town, full of life and activity, a real oasis in the desert, where the eye, wearied by the glare of the surrounding sand, finds rest in the welcome green of the trees and gardens scattered throughout the town. Ismaïlia contains a population of five thousand inhabitants, and is divided into French, Greek, and Arab quarters. On the banks of the lake are villas, each with its garden attached, and here at once becomes apparent the advantage obtained by the canal, which, as we have before said, the Company constructed at the outset of the undertaking. A channel 40 feet in width, by 9 feet in depth, was excavated from Zagazig, a distance of 50 miles On approaching Ismaïlia it was divided into two branches. One of these, after passing in front of the town, was connected by two locks with the maritime canal. These double locks are necessary, as the fresh-water canal has a superior level of about 17 feet. The waters of this canal irrigate the property of El Ouady, in the land of Goshen, and it was this estate which was originally purchased by the Company for £86,000. Subsequently the Egyptian Government repurchased it from them, together with certain rights of irrigation and tenancy that had been granted to them at the time of the sale, for £400,000, the sum awarded by Imperial arbitration. The other branch, passing a little to the west of the town, was continued in a southerly direction, and—after following, to a certain extent, the line of the maritime canal, and taking advantage, in the southern portion of its course, of the ancient canal of the Pharaohs—reached Suez after traversing a distance of 50 miles. This supply of water, coupled with the advantages of a safe and commodious inland port, will render Ismaïlia a place of much importance for the accommodation of shipping when passing through the canal; and it is at present the head-quarters of the canal administration in Egypt.

It will be as well, in this place, to give a brief account of the manner in which the traffic is conducted between Port Saïd and Suez. By this route, which was established more than two years and a half ago, passengers embark on board a small steamer at Port Saïd, and proceed by the maritime canal for a distance of 46 miles. They are then transferred into a barge on the fresh-water canal, which is towed by a small tug. In order to lessen as much as possible the wash which, by the ordinary means of steam

progression, would, in so narrow a canal, cause serious damage to the banks, the tug travels on a chain laid along the centre of the channel. The trajet from Port Saïd to Ismaïlia occupies about ten hours; and from the latter station to Suez, eleven hours. Merchandise is conveyed in lighters, drawing 4 feet of water, from Port Saïd to the locks which connect the maritime and fresh-water canals. Here they are passed through the locks, and proceed direct to Suez, by the latter canal. From the receipts from transit traffic by this route in 1867-68, we see that in the first three quarters of 1867 the receipts were £32,729. In the first three quarters of 1868 they amounted to £60,851, or nearly double the amount received in the previous year.

In the first quarter of 1867 the tonnage transported was 9,417 tons; during the first four months in 1868 it amounted to 29,420 tons. In 1867 the number of passengers was 50,250; in the first four months of 1868 this number was 15,437. In consequence of the reduced rate by which coal can now be delivered at Suez, as compared with the railway charges, the ton, which had previously cost from 70 to 75 shillings, is now reduced from 50 to 58 shillings.[1] The Company have discontinued their line of transit boats, which used to ply between Ismaïlia and Zagazig. Merchandise, going to and coming from the Zagazig and Ouady districts, is conveyed by native craft. In January and February, 1868, a considerable quantity of cotton and cereals produced in the districts was transported by this channel, leading into the maritime canal to Port Saïd, for exportation. Moreover, many pilgrims going to Mecca, from Asia Minor and Syria, disembark from the coasting steamers of the Mediterranean, and avail themselves of this direct line of transit to Suez. It is probable the Company will succeed in securing the greater portion of this large and regular traffic, which may hereafter be looked to as a source of considerable revenue.

It is at Ismaïlia that the railway, connecting Alexandria and Suez, approaches the line of the maritime canal. The railway system is now being rapidly developed in Egypt; and already 708 miles of lines are in operation. The recently-completed line from Suez to Ismaïlia (and thence to Benah, where it joins the old line

(1) Merchandise forwarded by the canal has an undoubted advantage over the railway. In many cases even time is saved, for the punctual delivery of goods cannot always be calculated on by the overburdened line of railway. Risk of damage from frequent and rough handling is also less on the canal, as merchandise is only twice trans-shipped—first from ship to lighter, then from lighter to ship in the other sea. By the railway this is increased to five changes: first, from ship to lighter; secondly, from lighter to railway truck; thirdly, from truck to railway depôt, either at Alexandria or Suez; fourthly, from depôt to lighter; fifthly, from lighter to ship. The Company's charge is £1 per ton for ordinary merchandise, and 16*s.* 8*d.* for coal.

between Cairo and Alexandria) will connect all Lower Egypt with the districts in proximity to the canal; and thus, whilst enhancing the value of the Company's lands, it will provide the eastern provinces of the Delta with a cheap and speedy means of transport for their exports from either Port Saïd or Suez. This new line, which runs in proximity to the fresh-water canal from Suez to Ismaïlia is about fifty miles in length. It was commenced by the Egyptian Government in the spring of 1868. Large levies of *fellahs* (*corvées*) were simultaneously set to work from Suez and from Ismaïlia, and in four months it was opened to traffic. This railway is intended to replace the original Alexandria, Cairo, and Suez line; and it possesses two important advantages over the latter. One is, that the steep gradients which severely tax the powers of the locomotives conveying heavy goods traffic between Suez and Cairo are avoided. The other advantage is that, instead of having to carry water-trucks for the supply of the engine-tanks, the fresh-water is obtained from the canal parallel to the line of railway. By this route there is a great saving of time for passengers passing through Egypt, the journey from Alexandria to Suez occupying only twelve hours. The direction taken by the original line seems to have had little to recommend its adoption, encountering, as it did, in one portion a steep gradient, and in another passing through an arid, uninhabited desert. It is possible that French advice at the Egyptian Court influenced this selection. The Viceroy may at that time have been led to believe that a line approaching the direction of Ismaïlia, and constructed under English auspices, might have materially interfered with the maritime canal works, and that, in the event of hostilities, it would favour, more than any other route, the advance of a British force from the Red Sea.

The characteristics of the first half of the maritime canal are that about 34 miles of its course lie through lakes, the remainder through plateaux of considerable elevation. The second half of the channel, from Ismaïlia to the Red Sea, divides itself into two distinct portions, the first, extending from where the canal skirts the eastern shore of Lake Timsah, and then enters the cuttings at Toussoum and Serapium, which carry it through the plateaux; the second, where it passes through the Bitter Lakes for a distance of about 24 miles, and then entering the last cutting at Chalouf, finally debouches, twelve miles further south, into the Red Sea, about a mile to the south-east of the town of Suez. From Lake Timsah to Toussoum the work is being carried on by dredges, and the dredgings are emptied into the lake. At Toussoum a dam is still retained to keep out the waters of the Mediterranean. This consequently is the southernmost point to which the waters of that sea have as yet been allowed to penetrate. The Serapium cutting is being executed with

dredges, which were originally forwarded by means of the maritime canal from Port Saïd to Ismaïlia. There they were passed through the locks into the fresh-water canal, which raised them 17 feet above the sea-level. A cross-cutting was then made from the fresh-water canal to the line of the works on the maritime canal, by which the machines were floated into their respective positions at this superior elevation. The dredgings are conveyed by lighters into large artificial lakes, which have been formed for this special purpose in close proximity to the maritime canal. These lakes were made in November, 1866, the level of the Nile then being at its highest point at that season. They contain upwards of 5,000,000 cubic yards of water, and are capable of receiving 2,800,000 cubic yards of dredgings. The lighters here employed have a very shallow draught of water, and wide overhanging sides, out of which the dredgings are discharged. When these dredges (of which nine are here at work, two *à long couloir*, and seven with lighters) have dredged to the requisite depth, the communication with the fresh-water canal will be closed, and the dam in the line of the maritime canal removed. By this means the level of the fresh water will fall to that of the sea-level, and the dredges, descending at the same time, will continue at work in completing the channel to its prescribed depth.

This is one of the points where it is proposed to irrigate and plant the embankments; indeed, this portion, and that near El Guisir, are the two sections where the sands of the desert are to be guarded against. The parallel course of the fresh-water canal will be of service as regards the Serapium portion; the vegetation that will by degrees spring up from the presence of this water will materially assist in arresting the drifts, more especially when the western embankment has been irrigated and planted.

As regards the amount of sand thus deposited in the channel of the canal, these drifts are only found to occur in the cuttings; in the other portions, the lakes, through which the channel is carried, will arrest their progress. In the El Guisir cutting the quantity that is annually drifted into the channel is 52,000 cubic yards. At Serapium, experience has proved that 392,400 cubic yards may be calculated on as about the amount that will fall into that section. At Chalouf, where the soil is argillaceous, there would seem to be no danger of drift. Of this there is a convincing proof in the present condition of the canal of the Pharaohs, which traversed this part of the desert. We may as well here also consider the question regarding the dredging that will be requisite in consequence of the deposit caused by the wash, as both are estimated together by the Company in calculating the cost of maintenance. Between Port Saïd and Kantara the inclination of the embankments is ex-

tremely slight, somewhat resembling a shelving sea-beach. The banks of this part of the canal, where the salt water has been introduced for a long time, are already becoming overgrown with sea-weed, which will assist in protecting them from the action of the wash, and this growth is also beginning in the El Guisir cutting. Moreover, time will sensibly decrease the amount of annual dredging necessitated by the wash, because the effect will be gradually to lessen the inclination of the embankments, thus reducing the direct action of the wave caused by passing traffic. At the present time the contractors are paid an annual sum representing the cost of dredging 520,000 cubic yards; and in practice, these terms have proved advantageous rather than otherwise to them. The estimate of the engineers now is, that when the canal is completed, the Company may calculate on having annually to remove, as a maximum, 650,000 cubic yards, resulting from drifts and from the effects of the wash. This is one quarter of the amount they now succeed in dredging every month. As the capacity of one of the large dredging machines equals 392,400 cubic yards in the year, two of these will suffice for the maintenance of the channel. As soon as the canal is finished, the Company become the proprietors of the whole of the machinery now employed by the contractors, and which has been purchased for them by the Company with this understanding. Consequently, it is estimated that the expense of this dredging will amount to less than £40,000 a year.

On emerging from the Serapium cutting, the canal at once enters the Bitter Lakes, through which it takes a central course. The original estimate of execution in this section was only 1,691,000 cubic yards. A large number of workmen are employed in this section. From the 15th of August to the 15th of September, 3,700 were at work. When the water is admitted into these basins, or dry depressions, it will give the requisite depth, in a great portion of the lakes, for the channel of the canal, thus carrying it over 24 miles of its course with but little expense or labour. These lakes are eventually to be filled mostly from the Mediterranean. A channel, with temporary regulating locks, will be constructed, and the estimated time for bringing the Bitter Lakes to the level of the sea is between five and six months. At the bottom of this dry depression, and covering an area 7 miles in length by 5 in width, there exists at present an elliptical-shaped bank of salt incrustations, and it was at one time feared that the removal of this would involve a great outlay. But recent experiments that have been made on large blocks of this incrustation, taken from several different localities, have demonstrated that, when acted on by water, it is readily dissolved. It would seem probable that this formation is the result of successive evaporations of salt water, at

the time when the Red Sea was gradually receding southwards; and a further proof of this is, that the deposits of shells, in both these lakes, correspond with those now found in the Red Sea.

There are many who incline to the belief that the passage of the children of Israel was across the lakes. In support of this theory, we may suppose that they formed a gulf of unequal depth at the northern extremity of the Red Rea. We read in the Bible with regard to this miraculous passage :—"And the Lord caused the sea to go back by a strong east wind, and the waters were divided, and the children of Israel went into the sea upon dry ground." If at that time the subsidence of the Red Sea had arrived at the stage which would have formed the Bitter Lakes into a gulf, connected only by a channel of moderate depth with the sea, a strong north-east wind, combined with a low tide, would have partially dried them, and the passage might thus have been easily effected. Whereas, a high tide acted on by a strong south wind, would again have rendered them impassable; and in this manner do those who hold this opinion say that Pharaoh and his host were overwhelmed, "when the sea returned to his strength as the morning appeared."

Passing out of the southern extremity of the lesser Bitter Lake, the channel enters the last cutting, at Chalouf. Owing to the hard and stony formation in this section, it was decided from the first that the work should here be carried out *à sec*, and it has proved most fortunate that this course was adopted, because at a considerable depth a stratum of conglomerate rock was found, which would have caused great expense and trouble to remove, had water been admitted. As it is, the whole amount, of about 52,000 cubic yards, was easily blasted and cleared away by manual labour. Fossil remains are here found, and those of the shark in considerable quantities. The Chalouf cutting gives employment to many thousands of workmen; the greater number are employed in wheeling away the soil, the remainder are at work in connection with the inclined planes and tramways. At no other point, perhaps, along the whole line of the works, does the mind more fully realise the gigantic nature of the undertaking than at this cutting, when looking from above into what resembles an excavated valley, of vast depth and width, and covered with a network of tramways, along which, as well as on the embankments, swarm thousands of busy workmen.

The remaining twelve miles from this point to the Red Sea present a continuous level plain, with an elevation but slightly above that of the sea. The first half of this section is being completed *à sec*, and the remaining portion by dredges. A connecting channel from the fresh-water canal was excavated, by which the dredges were introduced on the latter section, and they are now at work in fresh water, although close to the Red Sea. The advantage of this is, that

the machines are independent of the rise and fall of the tide; moreover, the water can be regulated, so as to float the dredges at the depth that insures their working to the greatest advantage. A certain amount of water finds its way into this cutting *à sec;* indeed, this may be said of all such portions where the soil is being thus excavated. The infiltrations are kept under by the employment of ten-horse power rotatory pumps, which pump the water out of reservoirs, and throw it beyond the embankments.

We have now arrived at the point where the canal enters the sea. Not more than four or five years ago, Suez was an insignificant Egyptian village, containing 4,000 inhabitants, but exhibiting no signs of life, except when the steamers of the Peninsular and Oriental Company, and, subsequently, those of the Messageries Impériales, were embarking or disembarking their passengers and merchandise. The absence of water, and the dearness of provisions, both of which had to be brought from Cairo and the surrounding districts, rendered it as uninviting a spot as can well be imagined. The advent of the fresh-water canal has brought about a marvellous change. The population has now increased to 25,000, and there is a degree of life and activity about the place clearly indicating the energy that is being displayed on all sides. The principal operations of the Company consist: firstly, in constructing a mole, 850 yards in length, at the mouth of the canal, to serve as a protection against southerly gales, and against the action of the tide at high-water; secondly, in dredging to the requisite depth the channel leading from the canal to the anchorage in the Roads of Suez; and thirdly, the reclamation of land. The mole, which projects from the Asiatic shore, is now nearly completed. It has been constructed with a kind of calcareous rock, which is quarried on the western shore of the bay. After entering the sea, the embouchure of the canal gradually widens to about 300 yards, and the depth in this portion is to be 27 feet. No rock has been found to interfere with the dredging, and but little work remains to complete this important part of the canal. Regarding the third and last point, the dredgings from the channel in the Roads of Suez are employed for this purpose. Embankments, faced with the same kind of stone that has been used for constructing the mole, are first built. Alongside, are moored dredges *à long couloir*, and by means of these ducts the dredgings are lodged behind the retaining embankments. This process is continued till a considerable elevation above the sea-level is obtained. Much land has already been reclaimed and built over, and the area is daily being extended. At a future date this property, of about 50 acres, will become of great value to the Company, for the requirements of shipping on its way through the canal.

On the south-western side much has been also accomplished. One

important work is the dry dock, which has been in use some years. This work was not carried out by the Maritime Canal Company. An arrangement was entered into between the Egyptian Government and the Messageries Impériales Company, by which the latter undertook to complete it for £240,000, with the following dimensions:—length, 415 feet, width 85 feet, and depth 29 feet, thus affording docking accommodation to the largest class of steamers. On the harbour side a double basin has been made, where there is a sufficient depth of water for vessels to lie alongside. Of the two piers already constructed, one is reserved by the Egyptian Government for their exclusive use; the other, on the northern side, is free to all, and they are directly connected by a railway, running along a jetty three-quarters of a mile in length, with the present terminal station in Suez. Passengers and merchandise will thus pass from the train into the steamer moored alongside the quay.

We have now taken a rapid survey of the works along the whole length of the maritime canal, and, at the same time, we have endeavoured to explain the various modes of operation by which the undertaking is rapidly progressing towards completion. Some of these have been employed from the outset, others have been subsequently adopted, according as the local experience gained by the engineers has from time to time suggested their introduction. Let us also avail ourselves of this eight or nine years' experience to see what light has been thrown on several points which some originally regarded as practically insurmountable obstacles to the successful realisation of this enterprise.

It was apprehended, in the first place, that the silting sands at Port Saïd and Suez would render it impossible for either port, but more especially the former, to be maintained in a condition at all times available for navigation. Secondly, that not only would the drifting sands of the desert obstruct the channel of the canal, but that the embankments, being formed, as was generally supposed, of nothing but sand along its entire length, would fall in as soon as excavated. Thirdly, that the levels of the two seas differed so materially as to render a navigable canal practically impossible. In answer to the first objection, it may be said that soundings taken at Port Saïd indicated a belt of sand along the shore for a distance of about 750 yards. Beyond this was found a compact muddy formation, not liable to displacement, and through which a channel could therefore be successfully dredged. It was concluded, and has since been proved to be correct, that if moles were carried out to a considerable distance beyond this belt of sand, the approach to the harbour would be free from the danger of being closed by silt. Two years and a half ago, when the moles were far from complete, the large steamers of the Messageries Impériales, engaged in the coasting trade of

Syria, frequented this port. At the present time, the portion of the shore contained in the angle formed by the western mole and the coast line, is advancing on the sea at the annual rate of about 20 yards. The fact would tend to prove that the drift sands extend only as far as the shoal water; and that at a limited distance from the shore, where a depth of 15 feet is attained, the quantity is inconsiderable. With reference to the second objection, we have already stated the results which have been ascertained from experiments, and by careful observations made by the engineers of the Company. In such portions as from the nature of the surrounding country are liable to the danger of the drifting sands, the Company propose to irrigate and plant the embankments, as an additional means of arresting the drifts. The fresh-water canal has, for several years, been conveying merchandise, passengers, and, at times, the Company's ponderous machinery. The width of this canal is only one-tenth of that of the maritime canal, and the depth is from 6 to 7 feet, but as yet no drifts have obstructed its course. It will be seen from the longitudinal section[1] (which also gives the geological formations through which the channel of the canal passes) that the maritime canal is only liable to the danger of drifting sands for about 22 miles of its course; the remaining 78 miles lie either through lakes, or through soil of a tenacious and consistent nature. Again, the fresh-water canal runs parallel to, and not far distant from, the western bank, for half its length. It is scarcely necessary to add that, wherever this Nile water becomes available, vegetation and cultivation will speedily follow; indeed, the banks of the fresh-water canal are already lined with a tangled fringe of reeds, tamarisk, with here and there young date trees; and wherever the water has infiltrated, green and swampy marshes are forming. In considering the third objection, it may be stated, that, taking the mean of the tides of the two seas, the actual difference in the levels is very insignificant, the Red Sea being only slightly higher.[2] Consequently, it is anticipated that the current will set towards the north, excepting during the prevalence of strong northerly winds, when it may be expected there will be little current either way. Regarding the loss of water by evaporation and percolation: the whole area of the maritime canal, including Lake Timsah and the Bitter Lakes, is estimated at about 465,000,000 square yards. The estimate of loss of water from these two causes is about 9,000,000 cubic yards a day; but the action of the tide at Suez is sufficient to introduce 15,080,000 cubic yards

(1) See p. 98 of the FORTNIGHTLY REVIEW for January.

(2) As the Red Sea has a tide of 6½ feet, whereas that of the Mediterranean is only 1¼, the mean tidal level of the former is about 2¾ feet above that of the latter. But as this is spread over a distance of 100 miles, it is, practically speaking, inappreciable.

between high and low water, hence the Company's engineers have no apprehensions from this cause.

We have seen the progress that is being made towards the completion of the maritime canal, the date for which has been fixed for 1st October, 1869. There remain one or two points of interest to be alluded to before concluding these remarks. The most important to the Company concerns its present financial position and future prospects. It will be seen that a sum much larger than the eight millions sterling, originally proposed and subsequently subscribed, has been found to be requisite. One cause of this has already been specified—namely, the substitution of other labour machinery for the *indigène* labour, which the Company had relied on obtaining. Moreover, the greater portion of the machinery, costing £2,400,000, and consuming about £40,000 of coal per month, would not have been purchased had the *fellah* clause been maintained. Further, by reason of the six years' delay beyond the time when it had been anticipated that the canal would be in operation, and the capital invested therein have become productive, the sum paid as interest at the rate of 5 per cent. on the capital subscribed, to the shareholders, has risen to twice the amount first estimated.

The original capital was subscribed in 400,000 shares of £20. Last year it became evident that a further sum would be required to complete the canal, and permission was obtained from the shareholders to open a subscription for placing 333,333 bonds in order to raise an additional sum of £4,000,000. These bonds, issued at £12, carrying interest at the rate of £1, are repayable in fifty years at £20. Favourable as are these terms, only £1,143,687 of this loan had been subscribed previous to June last; and, in order to enable the Company to obtain the remainder without further delay, the French Government allowed them, "in consideration," as was stated, "of the exceptional character of the enterprise, and the interest which France takes in the execution of the Suez Canal," to issue bonds, reimbursable by lottery-drawings. In accordance with this resolution, the Senate passed the following Bill in June:—"The Maritime Canal Company of Suez is hereby authorised to issue bonds, reimbursable by lottery-drawings, on the following conditions: 1st. The operation shall in no way involve the alienation of any of the capital engaged, and the titles are to bear a yearly interest at a no less rate than 3 per cent. of the nominal capital. 2nd. The sum annually devoted to prizes is not to exceed 1 per cent. of the capital. 3rd. The nominal value of the titles issued is not to be less than £20. The ulterior division of these is prohibited." Thus the attraction of a lottery, in which prizes varying from £80 to £6,000 to be drawn for quarterly, and amounting in the aggregate

to £40,000 a year, was added to the already favourable terms of the subscription. Hence it resulted that these bonds were taken up with extraordinary rapidity. In a few days after the opening of this lottery loan the whole of the large sum required, of £2,856,313, was subscribed. We subjoin an abstract of the general account laid before the shareholders at their Meeting, held on the 30th of April, 1868:—

Debit Account.

	£
General expenses in the formation of the Company, such as drawings, estimates, cost of subscription, &c., &c.	119,657
Properties purchased	47,030
Furnishing offices in France and Egypt	5,421
Interest accruing on shares in 1859, 1860, 1861, 1862, 1863, 1865, 1866, and 1867	1,968,217
Interest on bonds, to 1st April, 1868	51,501
Expenses of management, commissions, negotiations, &c.	614,098
Advances made to contractors	1,477,968
Matériel, stores, &c., &c.	1,372,085
Buildings, workshops, sheds for machinery, &c., &c.	166,328
Construction of canal, harbours, and other charges	5,245,904
Current Account	192,991
Equipment of transit service; rolling and floating stock	270,971
Total expenditure up to 30th April, 1868	11,532,171

Credit Account.

Original capital[1]	8,000,000
Imperial indemnity for revocation of concessions, &c., &c.[2]	3,360,000
Bonds subscribed previous to lottery loan, forming part of the £4,000,000 loan	1,143,687
Receipts previous to the final organisation of the Company	260
Interest on investments of unemployed capital	688,825
Receipts from the Company's properties	21,228
Various other receipts, negotiations, exchanges, &c., &c.	20,526
Net profit on the sale of "El Ouady" estate	305,021
Minor credits	16
Transit receipts	55,302
Transmission of funds between France and Egypt	259,001
Total receipts up to 30th April, 1868	13,853,866

Thus it appears that £13,853,866 is the sum received by the Company since its formation, whether from the original subscription, or bonds, or Egyptian indemnity, or from any other source. Deducting the sum already expended, there remained £2,321,695 to the credit of the Company on the 30th of April, 1868. This is made up of—1st, the sum of £962,500, still due on account of indemnity by the

(1) The Viceroy holds 177,642 of these shares, representing a payment of £3,552,840. We see, therefore, how largely his individual interests are involved in the success of the undertaking.

(2) This sum is to be paid in annuities; the first was paid in 1864; the last is due in 1879.

Egyptian Government; 2ndly, £233,925 on shares and bonds; 3rdly, £18,501 by minor debts; and 4thly, £1,106,769, the balance remaining in the bankers' hands in France and Egypt. Finally, to this general balance must be added £2,856,313, lately subscribed in the manner sanctioned by the French Government, which completed the loan of £4,000,000, making the total balance £5,178,008.

There are some who still entertain doubts as to whether even this sum will suffice to complete the canal. But we must remember that the Company's receipts are daily increasing, both by a rapidly-augmenting traffic, and from land which is being taken up for various purposes, even under the unsatisfactory conditions, both for the Company and the lessees, that are still in force. The exact monthly expenditure cannot easily be reckoned, as it fluctuates according to the work accomplished; but we do not think we shall be far wrong in estimating it at about £200,000. Taking this as the average for seventeen months—namely, from the 1st of May, 1868 (the date when the new account commenced), till the 1st of October, 1869—£3,400,000 represents the amount that will be required to complete the works; the difference, between this and the general credit balance before given, providing a wide margin for contingencies.

Partly owing to the nature of the enterprise—which, in the minds of many, continues to be looked upon as the futile attempt of a clever enthusiast to make a navigable channel one hundred miles in length through a desert of drifting sand—and partly on account of the completion of the canal having been protracted so much beyond the time originally specified, the shares in this Company are of a kind peculiarly liable to speculative fluctuations. Soon after the first issue of the bonds for the loan of £4,000,000 the shares fell 70 francs. The reason assigned for this was, that a part only of the necessary loan was taken up, and fears were entertained that there would not be found a sufficient sum to complete the undertaking. When, a few months ago, the remainder of the loan was in course of subscription, it was seen that much more money was forthcoming than was required. Nevertheless, on that occasion the shares also fell about 60 francs. On the other hand, in the spring of 1863, the financial prospects of the Company were not thus assured; relatively speaking, only slight progress had been made on the canal works, and, moreover, beyond a limited circle, little was known as to the real nature of the enterprise. There prevailed also a certain prejudice, founded on the early opposition which the Company had met with, and which the protracted delay in carrying out the works tended no doubt to strengthen. At that time the shares were worth about 558 francs. Now that the whole of the money required has been subscribed, and there no longer remains any doubt as to the completion of the canal within a limited time, the shares stand at

about 430 francs. From such irrational fluctuations as these, it is obvious that mere speculation has at all times greatly influenced their shares. There is no real reason why the loan, coupled as it was with a lottery, should have thus affected the shares, seeing that the consequent charges are to be met by the future revenues of the Company, extending over a period of fifty years.

A Commission, consisting of the leading engineers of the Company and others interested in the undertaking, recently assembled in Paris to regulate the conditions for the navigation of the canal. They decided upon allowing both paddle and screw steamers to steam through, at a maximum rate of six miles an hour. Thus they will pass from sea to sea in about sixteen hours. Sailing vessels exceeding 50 tons register, are to be towed at a rate that will admit of their transit in twenty-four hours, and vessels under 50 tons register are to be permitted to work their own way through the canal.

There exist already three large expanses of water—at Kantara, Lake Timsah, and the Bitter Lakes—but, with a view to affording additional facilities for navigation, the Commission advised the formation of ten basins, one at about every eight miles, throughout the course of the channel. Experiments are being made in order to ascertain the most efficient means of buoying and lighting the channel and the lakes. Port Saïd will be lighted by two fourth-class lights, one at the extremity of each mole; two lesser lights, at the entrance to the mouth of the canal; and, finally, one inner first-class light, which will be visible at a distance of twenty miles. The latter will be placed in alignment with the direction of the canal. Suez will, in like manner, be adequately lighted with five lights. As regards the transit charge on the tonnage of vessels, it appears that a French vessel of 300 tons register would, by English measurement, be only about 250 tons register, and according to American measurement from 150 to about 200 tons register. As the question relative to the adoption of a uniform measurement is about to be internationally considered, the Commission, while agreeing that it would probably be best to adopt the English measurement, think it advisable that in the meantime the Company should levy the dues in accordance with each vessel's national register.

It remains for us to consider what rights have been reserved to the Company on the transit of vessels. The 17th Article of the Act of Concession runs as follows :—

"In order to indemnify the Company for the cost of making and maintaining the canal, we authorise them, for as long as their tenure lasts, to establish certain rates (which may be subsequently modified) for transit, navigation, towage, and pilotage, subject to the following conditions:—1st. An identical transit due (as well as other attendant charges) to be levied equally, and without any favour or distinction as to nationality. 2nd. The rate of this transit due, and the other charges, to be published in all the principal towns and seaports

which will be affected by the opening of the canal, three months prior to the opening of the navigation. 3rd. In no case is the maximum of ten francs per ton, or ten francs per passenger, to be exceeded."

M. de Lesseps originally named 3,000,000 tons as the amount of shipping which he anticipated would annually pass through the canal. Last year, however, he stated to the shareholders that the great commercial development which has taken place since the formation of the Company justified him in saying they might now reasonably expect that the amount would be 6,000,000 tons in the second year after the opening of the canal; retaining 3,000,000 tons as a minimum for the first year. On the same occasion he went on to say, "Thus France will have subscribed the greater portion of your capital, but England will pay you the largest proportion of your dividends."

A route that will diminish by one-half, the distance lying between the two great divisions of mankind who are at present commercially dependent on one another, that is to say, between upwards of 250,000,000 of Europeans on one side, exporting their manufactures to Oriental nations, representing in numbers an aggregate of 600,000,000, and from whom, in return, they obtain, in raw material, the products of a soil of wonderful fertility, must, before many years have elapsed, become the established channel of communication by which the greater portion of this trade will be transported. We should gladly welcome the realisation of M. de Lesseps' anticipations; but we cannot entertain these sanguine views so long as commercial enterprise continues to feel the check occasioned by the panic of 1866. One result of this stagnation has been that freight can at present be obtained at an extremely low rate to and from the East. Hence there are many staple articles of commerce, and these include the less costly and bulky cargoes, on which, under present circumstances, the transit duty of 10 francs per ton would weigh heavily, though in itself not an excessive charge. Certain merchandise of the more valuable class, for export and import, that can bear the rates of steam freight, will doubtless be diverted to this route, whenever the canal is well established.[1] In such shipments, the saving on a valuable consignment, by earlier delivery in the markets, will more than reimburse the transit dues on the cargo. The Netherlands Commission, as also the promoters of the Maritime Canal Company, went very fully into the question as to the advantages to be gained by sailing vessels in taking the Suez route. The general result then arrived at was that there would be a saving in expense on ordinary

(1) As exports, this may include cotton goods, yarns, woollens, haberdashery, copper, and hardware. And, as imports—cotton, wool, ivory, gums, coffee; silk, tea, and indigo from Calcutta; tea and silk from China.

cargoes, when the season of the voyage was such as to enable the owners to calculate on a saving of about eighteen or twenty days by the adoption of the canal route, as compared with the probable length of the passage round the Cape. We are, however, inclined to doubt if, in these calculations, they made a sufficient allowance for the heavy rate of insurance on sailing vessels in the Red Sea. This amounts to 4 per cent., or at least double the rate of insurance from the United Kingdom to Bombay or Kurrachee.

For the purposes of navigation by sailing vessels, this sea has, since the earliest times, had an unenviable notoriety. Notwithstanding the improved lighting, and the more extended knowledge that prevails regarding its navigation, the rate of insurance remains unchanged; and the dangers still attendant on sailing in its waters, from want of sea room, and its numerous coral reefs, are so disadvantageous as generally to preclude its adoption by mere sailing ships of large size. Certain months there are, when vessels run but slight risk, or even the chance of detention by unfavourable winds. For instance, a ship leaving England in August would probably have a fair wind both outward and homeward bound. Again, it may occasionally answer to combine this route with that round the Cape, either for the outward or homeward voyage, provided that the period for navigating the Red Sea be made to coincide with the season during which a favourable wind may generally be expected. For, from March to October, the prevailing winds in the Mediterranean, and in the northern portion of the Red Sea, are generally westerly and north-westerly. Again, they are variable from November to March in the latter sea, though generally south-easterly; and this is likewise the season when bad weather may be expected there. Notwithstanding, therefore, that the winter months may be there considered as favouring a return voyage, the whole of the period from March till October is no doubt unfavourable for sailing vessels.

Another disadvantage of this sea is that, during a great part of the year, vessels are liable, either when homeward or outward bound, to encounter head winds, after traversing half its length. When, therefore, we consider this liability to delay in the Red Sea, and its overpowering heat at certain seasons, a possible detention in the Straits of Babelmandeb and of Gibraltar, the heavy rate of insurance, and the transit dues, these, it must be allowed, present a formidable combination of objections to its navigation by sailing ships. However, we believe that the Company do not now anticipate that any large proportion of the regular traders will be diverted to the canal route; but they look forward, rather, to the speedy recognition of the advantages to be derived from the employment of steam power in trading with the East.

With regard to what has already been accomplished by us towards this conversion, it appears that in the year 1841, we built 1,141 sailing vessels, registered tonnage 160,000; and in the same year we launched 48 steamers, registered tonnage 11,500. In 1860, only 820 sailing vessels were built, having the same capacity as in 1841, but in that year the number of steamers that were launched was 200, registered tonnage 54,000. The last Parliamentary return of steam vessels registered in the United Kingdom shows that on or before the 1st of January, 1868, there were 2,889 steam vessels, registered tonnage 891,429, representing 1,910,033 gross tonnage.

Admitting this great increase within the last thirty years, more especially marked within the last ten years, in the number of steamers, the proportion at present engaged in such trade as would find advantage in employing the Suez route is so insignificant that we fear, till such time as it becomes remunerative to send the bulky articles of commerce in steamers, the Canal Company may not find their revenues increased by the trade of the United Kingdom to the extent they have been led to expect. We believe there is only one regularly established line of steamers by the Cape for conveying merchandise between this country and Eastern ports.[1] It would appear that, in the year 1867, the exports and imports between the United Kingdom and India, China, Japan, and the Australian colonies, were 2,611,803 tons. In the same year the imports of cotton from the East, conveyed in steamers to Suez, and from Alexandria to the United Kingdom, amounted to 96,068 bales, equal to a tonnage of 24,000 tons, and that of other merchandise of the more valuable class—such as silks, teas, coffee, ivory, gums, &c., &c. —amounted, in the same year, to 3,000 tons. Although in itself this quantity is insignificant, when compared with the total amount of tonnage of the Eastern trade, it nevertheless affords us a sufficiently clear indication of what may be expected to pass by this route as soon as the communication with India, China, Japan, and the Australian colonies is opened to commerce.

The following table gives the relative distances by the Cape route, and by the canal, from England, America, Russia, and France, to India:—

	Viâ Cape of Good Hope.	Viâ Suez Canal.	Saving.
England to Bombay (in nautical miles)	10,860	6,020	4,840
New York to Bombay ditto	11,520	7,920	3,600
St. Petersburg to Bombay ditto	11,610	6,770	4,840
Marseilles to Bombay ditto	10,560	4,620	5,940

(1) That of Messrs. Holt of Liverpool. This line consists of six steamers, registered tonnage 8,718. They run between Liverpool, the Mauritius, Penang, Singapore, Hong Kong, and Shanghai.

But, as we before observed, the real question is as to the substitution of steam power, auxiliary or otherwise, in lieu of sailing vessels, for the general purposes of commerce with the East: and there can be no doubt that those who may see their interest in adopting the shorter route, will be influenced by the consideration of the time thereby gained. This being the case, they are not likely to neglect the advantage which steam power places within their reach for shortening the time of the voyage, as well as rendering the date of arrival a matter of punctuality. In their Report the Netherlands Commission observed:—

"It is certain that the opening of the canal will give a prodigious development to the trade of the Mediterranean seaboard, and that all the commerce of those parts with the most distant portions of the East will pass by steamers, or in auxiliary steam vessels."

Obviously one important reason why steam power has as yet been so little employed in the extended lines of commercial intercourse is the extent of stowage required for the large quantity of coal to be carried when a whole continent has to be doubled or a three or four thousand mile stage to be run. By the canal route the facilities for coaling at the easy stations of Malta, Port Saïd, Suez, and Aden will entirely obviate the objection to this employment of steamers in trading between Europe and the East.

The work accomplished monthly by the dredging machinery, and by the other modes of excavating, already proves that, unless anything unforeseen happens, such as an epidemic among the workmen, the maritime canal will be open by the date named for its completion. So wide a field is thus opened by the effect this line will produce in diverting the commerce which now passes by the route round the Cape of Good Hope—in use ever since its discovery by the Portuguese in 1497—and in creating, or rather in reviving the large trade which, in remote ages, was carried on between the Mediterranean and the East, that space does not admit of our here entering upon so many interesting subjects. But when we consider that Marseilles, for example, will by this means be brought within twenty-five days of Ceylon, and, in a corresponding degree, all other French, Italian, German, and Greek ports, it does seem more than probable that this route will eventually absorb the greater portion of the trade and traffic to and from the Eastern seas as soon as steamers become more generally employed for commercial purposes. The saving of distance by the Suez route over the Cape voyage amounts to 49 per cent. for English ports; whereas France, Southern Russia, Italy, Turkey, and Greece, gain 52 per cent. The extended commerce which this channel will open to Mediterranean shipping may result in Italian and Greek coasters re-establishing that intercourse to which allusion has been made, as well as absorbing, in a great

measure, the existing trade of Arabia and the Eastern shores of Africa. The important markets of the Mauritius, Réunion, and Madagascar will be easily within their reach. The proverbially thrifty habits and well-known seafaring aptitude of both Italians and Greeks will give them considerable advantage in competing with our large ships and more costly equipments. Thus Italy and Greece, both of which have hitherto carried on their navigation principally within the limits of the ports of the Archipelago, the shores of Asia Minor, and the Black Sea, and have been in a great measure dependent on northern traders for so many commodities, will then be able to hold their own, in supplying such articles as cotton, coffee, sugar, spices, foreign woods, gums, ivory, and various other articles of merchandise, to the large populations who are mainly dependent on the Italian and Greek seaboard for this class of imports. And, not the least of its advantages to ourselves may be the benefits it will confer on our Indian Empire when the Punjaub and Eastern Bengal are connected by railways to the western ports of Bombay and Kurrachee.

Comprehensive as this aspect no doubt is in a commercial point of view, the completion of the canal will develop other features of importance and interest; but space does not admit of our here entering on them. It would seem to be the desire of the Egyptian Government that all nations should be placed on an equal footing in respect to the advantages which the route will afford to their intercourse with the East. It is interesting to speculate on the changes that may within a few years occur in the commercial, social, and political relations of countries lying on or near this line of ready intercourse. By means of this Egyptian Bosphorus, as it has been called, European nations will come in constant contact with many uncivilised races, inhabiting regions which border on the shores of Arabia, and Africa on the north and east.

We have no personal knowledge of M. de Lesseps, who has been throughout so instrumental in planning and executing this great work, nor are we personally interested in this scheme. But having ourselves seen what has been accomplished in overcoming natural obstructions; moreover, having in our recollection those other grave difficulties to which we have alluded as successfully surmounted; we cannot take leave of this subject without an expression of admiration for M. de Lesseps and his colleagues, to whose public spirit and dauntless perseverance the world will be indebted for the realisation of this stupendous project.

J. Clerk.

ON CHEMICAL RAYS, AND THE LIGHT OF THE SKY.[1]

THE first physical investigation of any importance in which, jointly with my friend Professor Knoblauch, I took part, bore the title, "The Magneto-optic Properties of Crystals, and the Relation of Magnetism and Diamagnetism to Molecular Arrangement."[2] This investigation compelled me to reflect upon the structure of crystals, on their optical properties in relation to that structure, and more particularly on the striking phenomena exhibited by many of them in the field of a sufficiently powerful magnet. These were evidently due to the manner in which the molecules of the crystals were built together by the force of crystallization: and it was natural, if not necessary for me, to employ such strength of imagination as I possessed in obtaining a mental picture of this molecular architecture. The inquiry gave a tinge and bias to my subsequent scientific thought, rendering, as it did, the conceptions and pursuit of molecular physics pleasant to me. Its influence is to be traced in most of my scientific work. The first lecture, for example, which I ever delivered in this theatre, was "On the Influence of Material Aggregation on the Manifestations of Force;" by "material aggregation" being meant the way in which, by nature or by art, the particles of matter are arranged together. In 1853 I also published a paper "On Molecular Influences," in which common heat was made the explorer of organic structure. In the "Bakerian Lecture," given before the Royal Society in 1855, the same idea and phraseology crop out. The Bakerian Lecture for 1864 bears the title "Contributions to Molecular Physics." And all through the investigations which have occupied me during the last ten years, my wish and aim have been to make radiant heat an instrument by which to lay hold of the ultimate particles of matter.

The labours now to be considered lie in the same direction. In the researches just referred to, I employed tubes of glass and brass, called, for the sake of distinction, "experimental tubes," in which radiant heat was acted upon by the gases and vapours subjected to examination. Wishing two or three months ago to render visible what occurred within these tubes on the entrance of the gases or vapours, I found it necessary to intensely illuminate their interiors. The source of illumination chosen was the electric light, the beam of which, converged by a suitable lens, was sent along the axis of the

(1) A discourse prepared for delivery in the Royal Institution, on the 15th of January, 1869.

(2) Philosophical Magazine, July, 1850.

tube. The dirt and filth in which we habitually live were strikingly revealed by this method of illumination. For wash our tube as we might with water, alcohol, acid, or alkali, until its appearance in ordinary daylight was that of absolute purity, the delusive character of this appearance was in most cases revealed by the electric beam. In fact, in air so dirty as that which supplies our lungs—and I will not say that we could get on healthily without the "dirt" [1]—it is not possible to be more than approximately cleanly.

Vapours of various kinds were sent into a glass experimental tube a yard in length, and about three inches in diameter. As a general rule, the vapours were perfectly transparent; the tube when they were present appearing as empty as when they were absent. In two or three cases, however, a faint cloudiness showed itself within the tube. This caused me a momentary anxiety, for I did not know how far, in describing my previous experiments, actions might have been ascribed to pure cloudless vapour which were really due to those newly-observed nebulæ. Intermittent discomfort, however, is the normal feeling of the investigator; for it drives him to closer scrutiny, to greater accuracy, and often, as a consequence, to new discovery. It was soon found that the nebulæ revealed by the beam were also *generated* by the beam, and the observation opened a new door into that region inaccessible to sense, which embraces so much of the intellectual life of the physical investigator.

What *are* those vapours of which we have been speaking? They are aggregates of *molecules*, or small masses of matter, and every molecule is itself an aggregate of smaller parts called *atoms*. A molecule of aqueous vapour, for example, consists of two atoms of hydrogen, and one of oxygen. A molecule of ammonia consists of three atoms of hydrogen, and one of nitrogen, and so of other substances. Thus the molecules, themselves inconceivably small, are made up of distinct parts still smaller. When, therefore, a compound vapour is spoken of, the corresponding mental image is an aggregate of molecules separated from each other, though still exceedingly near, each of these being composed of a group of atoms still nearer to each other. So much for the *matter* which enters into our conception of a vapour.[2] To this must now be added the idea of *motion*. The molecules have motions of their own *as wholes;* their constituent atoms have also motions of their own, which are executed independently of those of the molecules; just as

(1) This "dirt" consists in great part of organic germs, of the functions of which in the animal economy we are as yet ignorant.

(2) Newton seemed to consider that the molecules might be rendered visible by microscopes; but of the atoms he appears to have entertained a different opinion. He finely remarks:—"It seems impossible to see the more secret and noble works of nature within the corpuscles, by reason of their transparency." (Herschel, "On Light," Art. 1145.)

the various movements on the earth's surface are executed independently of the orbital revolution of our planet.

The vapour molecules are kept asunder by forces which, virtually or actually, are forces of repulsion. Between these elastic forces and the atmospheric pressure under which the vapour exists, equilibrium is established as soon as the proper distances between the molecules have been assumed. If, after this, the molecules be urged nearer to each other by a momentary force, they recoil as soon as the force is expended. If by the exercise of a similar force they be separated more widely, when the force ceases to act they again approach each other. The case is different as regards the constituent atoms.

And here let me remark that we are now upon the very outmost verge of molecular physics; and that I am attempting to familiarise your minds with conceptions which have not yet obtained universal currency even among chemists; which many chemists, moreover, might deem untenable. But, tenable or untenable, it is of the highest scientific importance to discuss them. Let us, then, look mentally at our atoms grouped together to form a molecule. Every atom is held apart from its neighbours by a force of repulsion; why, then, do not the mutually repellent members of this group part company? The molecules *do* separate from each other when the external pressure is lessened or removed, but the atoms do not. The reason of this stability is that *two* forces, the one attractive and the other repulsive, are in operation between every two atoms; and the position of every atom—its distance from its fellows—is determined by the equilibration of these two forces. If the atoms come too near, repulsion predominates and drives them apart; if too distant, attraction predominates and draws them together. The point at which attraction and repulsion are equal to each other is the atom's *position of equilibrium*. If not absolutely cold—and there is no such thing as absolute coldness in our corner of nature—the atoms are always in a state of vibration, their vibrations being executed to and fro *across their positions of equilibrium*.

Into a vapour thus constituted, we have now to pour a beam of light. But what, in the first instance, *is* a beam of light? It is a train of innumerable waves, excited in, and propagated through, an almost infinitely attenuated and elastic medium, which fills all space, and which we name the Æther. These waves of light are not all of the same size: some of them are much longer and higher than others. Now the short waves and the long ones move with the same rapidity through space, just as short and long waves of sound travel with the same rapidity through air. Hence the shorter waves must follow each other in quicker succession than the longer ones. The different rapidities with which the waves of light impinge upon

the retina, or optic nerve, give rise in consciousness to differences of *colour*. There are, however, numberless waves emitted by the sun and other luminous bodies which reach the retina, but which are incompetent to excite the sensation of light. If the lengths of the waves exceed a certain limit, or if they fall short of a certain other limit, they cannot generate vision. And it is to be particularly borne in mind that the capacity to produce *light* does not depend so much on the *strength* of the waves, as on their *periods of recurrence*. I have often permitted waves to enter my own eye, of a power which, if differently distributed, would have instantly and utterly ruined the optic nerve, but which failed to produce any impression whatever upon consciousness, because their periods were not those demanded by the retina.

The elements of all the conceptions with which we shall have subsequently to deal are now in your possession. And you will observe that though we are speaking of things which lie entirely beyond the range of the senses, the conceptions are as truly *mechanical* as they would be if we were dealing with ordinary masses of matter, and with waves of sensible magnitude. I do not think that any really scientific mind at the present day will be disposed to draw a substantial distinction between chemical and mechanical phenomena. They differ from each other as regards the magnitude of the masses involved; but in this sense the phenomena of astronomy differ, also, from those of ordinary mechanics. The main bent of the natural philosophy of a future age will probably be to chasten into order, by subjecting it to mechanical laws, the existing chaos of chemical phenomena.

Whether we see rightly or wrongly—whether our intellection be real or imaginary—it is of the utmost importance in science to aim at perfect clearness in the description of all that comes, or seems to come, within the range of the intellect. For if we are right, clearness of utterance forwards the cause of right; while if we are wrong, it ensures the speedy correction of error. In this spirit, and with the determination at all events to speak plainly, let us deal with our conceptions of æther waves and molecules. Supposing a wave, or a train of waves, to impinge upon a molecule so as to urge all its parts with the same motion, the molecule would move bodily as a whole, but because they are animated by a *common motion* there would be no tendency of its constituent atoms to separate from each other. *Differential motions* among the atoms themselves would be necessary to effect a separation, and if such motions be not introduced by the shock of the waves, there is no mechanical ground for the decomposition of the molecule.

It is, however, difficult to conceive the shock of a wave, or a train of waves, so distributed among the atoms as to cause no strain

amongst them. For atoms are of different weights, probably of different sizes; at all events it is almost certain that the ratio of the mass of the atom to the surface it presents to the action of the waves is different in different cases. If this be so, and I think the probabilities are immensely in favour of its being so, then every wave which passes over a molecule tends to decompose it—tends to carry away from their weightier and more sluggish companions those atoms which, in relation to their mass, present the largest resisting surfaces to the motion of the waves. The case may be illustrated by reference to a man standing on the deck of a ship. As long as both of them share equally the motions of the wind or of the sea, there is no tendency to separation. In chemical language, they are in a state of combination. But a wave passing over it finds the ship less rapid in yielding to its motion than the man; the man is consequently carried away, and we have what may be regarded as decomposition.

Thus the conception of the decomposition of compound molecules by the waves of æther comes to us recommended by *à priori* probability. But a closer examination of the question compels us to supplement, if not materially to qualify, this conception. It is a most remarkable fact, that the waves which have thus far been found most effectual in shaking asunder the atoms of compound molecules are those of least mechanical power. *Billows*, to use a strong comparison, are incompetent to produce effects which are readily produced by *ripples*. It is, for example, the violet and ultra-violet rays of the sun that are most effectual in producing these chemical decompositions; and, compared with the red and ultra-red solar rays, the energy of these "chemical rays" is infinitesimal. This energy would probably in some cases have to be multiplied by millions to bring it up to that of the ultra-red rays; and still the latter are powerless where the smaller waves are potent. We here observe a remarkable similarity between the behaviour of chemical molecules and that of the human retina. The energy transmitted to the eye from a candle-flame half a mile distant is more than sufficient to inform consciousness; while waves of a different period, possessing twenty thousand million times this energy, have been suffered to impinge upon my own retina, with an absolute unconsciousness of any effect whatever—mechanical, physiological, chemical, or thermal.

Whence, then, the power of these smaller waves to unlock the bonds of chemical union? If it be not a result of their strength, it must be, as in the case of vision, a result of their periods of recurrence. But how are we to figure this action? I should say thus: the shock of a single wave produces no more than an infinitesimal effect upon an atom or a molecule. To produce a larger effect, the motion must *accumulate*, and for wave-impulses to accumulate,

they must arrive in periods identical with the periods of vibration of the atoms on which they impinge. In this case each successive wave finds the atom in a position which enables that wave to add its shock to the sum of the shocks of its predecessors. The effect is mechanically the same as that due to the timed impulses of a boy upon a swing. The single tick of a clock has no appreciable effect upon the unvibrating and equally long pendulum of a distant clock; but a succession of ticks, each of which adds, at the proper moment, its infinitesimal push to the sum of the pushes preceding it, will, as a matter of fact, set the second clock going. So likewise a single puff of air against the prong of a heavy tuning-fork produces no sensible motion, and, consequently, no audible sound; but a succession of puffs, which follow each other in periods identical with the tuning-fork's period of vibration, will render the fork sonorous. I think the chemical action of light is to be regarded in this way. Fact and reason point to the conclusion that it is the heaping up of motion on the atoms, in consequence of their synchronism with the shorter waves, that causes them to part company. This I take to be the mechanical cause of these decompositions which are effected by the waves of æther.

And now let us return to that faint cloudiness, already mentioned, from which, as from a germ, these considerations and speculations have sprung. It has been long known that light effected the decomposition of a certain number of bodies. The transparent iodide of ethyl, or of methyl, for example, becomes brown and opaque on exposure to light, through the discharge of its iodine. The art of photography is founded on the chemical actions of light, so that it is well known that the effects for which the foregoing theoretic considerations would have prepared us, are not only probable, but actual.

But the method employed in the experiments in which the cloudiness above referred to was observed, and which consists simply in offering the *vapours* of volatile substances to the action of light, enables us not only to give such experiments a beautiful form, but also to give a vast extension to the operations of light, or rather of radiant force, as a chemical agent. It also enables us to illustrate in our laboratories actions which have been hitherto performed only in the laboratory of nature. A few of these actions of a representative character I have now to bring before you; and, in doing so, I will take advantage of the fact that, in a great number of cases, one or more of the substances into which the waves of light break up compound molecules are comparatively *involatile*. These products of decomposition require a greater heat than is required by the vapours from which they are derived to keep them in the gaseous form; and hence, if the space in which these new bodies are liberated be of

the proper temperature, they will not remain in the vaporous condition, but will precipitate themselves as liquid particles, thus forming visible clouds upon the beam to the action of which they owe their existence.

We will now commence our illustrative experiments. I hold in my hand a little flask, which is stopped by a cork, pierced in two places. Through one orifice passes a narrow glass tube, which terminates immediately under the cork; through the other orifice passes a similar tube, descending to the bottom of the little flask, which is filled to a height of about an inch with a transparent liquid. The name of this liquid is *nitrite of amyl*, in every molecule of which we have 5 atoms of carbon, 11 of hydrogen, 1 of nitrogen, and 2 of oxygen. Upon this group the waves of our electric light will be immediately let loose. The large horizontal tube that you see before you is what I have called an "experimental tube;" it is connected with our small flask, a stop-cock, however, intervening between them, by means of which the passage between the flask and the experimental tube can be opened or closed at pleasure. The other tube, passing through the cork of the flask and descending into the liquid, is connected with a U-shaped vessel, filled with fragments of clean glass, covered with sulphuric acid. In front of the U-shaped vessel is a narrow tube stuffed with cotton-wool. At one end of the experimental tube, is our electric lamp; and here, finally, is an air-pump, by means of which the tube has been exhausted. We are now ready for experiment.

Opening the cock cautiously, the air of the room passes, in the first place, through the cotton-wool, which holds back the numberless organic germs and inorganic dust-particles floating in the atmosphere. The air, thus cleansed, passes into the U-shaped vessel, where it is *dried* by the sulphuric acid. It then descends through the narrow tube to the bottom of the little flask, and escapes there through a small orifice into the liquid. Through this it bubbles, loading itself to some extent with the nitrite of amyl vapour, and then the air and vapour enter the experimental tube together.

The closest scrutiny would now fail to discover anything within this tube; it is, to all appearance, absolutely empty. The air and the vapour are both invisible. We will permit the electric beam to play upon this vapour. The lens of the lamp is so situated as to render the beam slightly convergent, the focus being formed in the vapour at about the middle of the tube. You will notice that the tube remains dark for a moment after the turning on of the beam; but the chemical action will be so rapid that attention is requisite to mark this interval of darkness. I ignite the lamp; the tube for a moment seems empty; but suddenly the beam darts through a luminous white cloud, which has banished the preceding darkness.

It has, in fact, shaken asunder the molecules of the nitrite of amyl, and brought down upon itself a shower of liquid particles which cause it to flash forth in your presence like a solid luminous spear. It is worth while to mark how this experiment illustrates the fact, that however intense a luminous beam may be, it remains invisible unless it has something to shine upon. *Space*, though traversed by the rays from all suns and all stars, is itself unseen. Not even the æther which fills space, and whose motions are the light of the universe, is itself visible.

You notice that the end of the experimental tube most distant from the lamp is free from cloud. Now the nitrite of amyl vapour is there also, but it is unaffected by the powerful beam passing through it. Let us make the transmitted beam more concentrated by receiving it on a concave silver mirror, and causing it to return by reflection into the tube. It is still powerless. Though a cone of light of extraordinary intensity now traverses the vapour, no precipitation occurs, no trace of cloud is formed. Why? Because the very small portion of the beam competent to decompose the vapour is quite exhausted by its work in the frontal portions of the tube. The great body of the light which remains, after this sifting out of the few effectual rays, has no power over the molecules of nitrite of amyl. We have here, strikingly illustrated, what has been already stated regarding the influence of *period*, as contrasted with that of *strength*. For the portion of the beam which is here ineffectual has probably more than a million times the absolute energy of the effectual portion. It is energy specially related to the atoms that we here need, which specially related energy being possessed by the feeble waves, invests them with their extraordinary power. When the experimental tube is reversed so as to bring the undecomposed vapours under the action of the *unsifted* beam, you have instantly this fine luminous cloud precipitated.

The light of the sun also effects the decomposition of the nitrite of amyl vapour. A small room in the Royal Institution, into which the sun shone, was partially darkened, the light being permitted to enter through an open portion of the window-shutter. In the track of the beam was placed a large plano-convex lens, which formed a fine convergent cone in the dust of the room behind it. The experimental tube was filled in the laboratory, covered with a black cloth, and carried into the partially darkened room. On thrusting one end of the tube into the cone of rays behind the lens, precipitation within the cone was copious and immediate. The vapour at the distant end of the tube was shielded by that in front; but on reversing the tube, a second and similar splendid cone was precipitated.

Now let us pause for a moment and glance at the ground over which we have passed. We have defined a vapour as an aggregate

of molecules mutually repellent, but hindered from indefinitely retreating from each other by an external pressure. We have defined a molecule as an aggregate of atoms maintained in positions of equilibrium by the equalised action of two opposing forces, and always oscillating to and fro across those positions. We have defined a beam of light as a train of innumerable waves, and have illustrated their chemical action. We have learned that it is not the magnitude or power of the waves, so much as their periods of recurrence, that renders them effectual as chemical agents. We have also seen, how the luminous beam is sifted by the vapour which it decomposes, and deprived of those rays which are competent to effect the decomposition. The effects, moreover, obtained with the electric beam are also produced by the beams of the sun.

And here I would ask you to make familiar to your minds the idea that no chemical action can be produced by a ray that does not involve the destruction of the ray. But the term "ray" is unsatisfactory to us at present, when our desire is to abolish all vagueness, and to affix a definite physical significance to each of our terms. Abandoning the term ray as loose and indefinite, we have to fix our thoughts upon the *waves* of light; and to render clear to our minds that those waves which produce chemical action do so by delivering up their own motion to the molecules which they decompose. We have here forestalled to some extent a question of great importance in molecular physics, which, however, is worthy of being fixed more definitely in your mind. It is this:—when the waves of æther are intercepted by a compound vapour, is the motion of the waves transferred to the molecules of the vapour, or to the atoms of the molecules? We have thus far leaned to the conclusion that the motion is communicated to the atoms; for if not to these individually, why should they be shaken asunder? The question, however, is capable of, and is worthy of, another test, the bearing and significance of which you will immediately appreciate.

As already explained, the molecules are held in their positions of equilibrium by their mutual repulsion on the one side, and by an external pressure on the other. Their rate of vibration, if they vibrate at all, must depend upon the elastic force which they mutually exert. If this force be changed, the rate of vibration must change along with it; and after the change the molecules could no longer absorb the waves which they absorbed prior to the change. Now the elastic force between molecule and molecule is utterly altered when a vapour passes to the liquid state. Hence, if the liquid absorbs waves of the same period as its vapour, it is a proof that the absorption is not effected by the molecules. Let us be perfectly clear on this important point. Those waves are absorbed whose vibrations synchronise with those of the molecules or atoms on which they im-

pinge; a principle which is sometimes expressed by saying that bodies radiate and absorb the same rays. This great law, as you know, is the foundation of spectrum-analysis; it enabled Kirchhoff to explain the lines of Frauenhofer, and to determine the chemical composition of the atmosphere of the sun. If then, after such a change as that involved in the passage of a vapour to the liquid state, the same waves are absorbed as were absorbed prior to the passage, it is a proof that the molecules, which must have utterly changed *their* periods, cannot be the seat of the absorption; and we are driven to conclude that it is to the *atoms*, whose rates of vibration are unchanged by the change of aggregation, that the wave-motion is transferred. If experiment should prove this identity of action on the part of a vapour and its liquid, it would establish in a new and striking manner the conclusion to which we have previously leaned.

We will now resort to the experimental test. In front of this experimental tube, which contains a quantity of the nitrite of amyl vapour, is placed a glass cell a quarter of an inch in thickness, filled with the liquid nitrite of amyl. I send the electric beam first through the liquid, and then through its vapour. The luminous power of this beam is very great, but it can make no impression upon the vapour. The liquid has robbed it completely of its effective waves. I remove the liquid; chemical action immediately commences, and in a moment we have the apparently empty tube filled with this bright cloud, precipitated by one portion of the beam, and illuminated by another. I re-introduce the liquid; the chemical action instantly ceases. I again remove the liquid, and the action commences once more. Thus we uncover in part the secrets of this world of molecules and atoms.

Instead of employing air as the vehicle by which the vapour is carried into the experimental tube, we may employ oxygen, hydrogen, or nitrogen. With hydrogen curious effects are observed, due to the sinking of the clouds through the extremely light gas in which they float. They illustrate, without proving, the argument of those who say that the clouds of our own atmosphere could not float if the cloud particles were not little bladders, instead of full spheres. Before you is a tube filled with the nitrite of amyl vapour, which has been carried into the tube by hydrogen gas. On sending the beam through the tube a delicate bluish-white cloud is precipitated. A few strokes of the pump clear the tube of this cloud, but leave a residue of vapour behind. Again turning in the beam we have a second cloud, more delicate than the first, precipitated. This may be done half-a-dozen times in succession. A residue of vapour will still linger in the tube sufficient to yield a cloud of exquisite delicacy, both as regards colour and texture.

Besides the nitrite of amyl a great number of other substances might be employed, which, like the nitrite, have been hitherto not

known to be chemically susceptible to light. But I confine myself at present to this representative case. One point, however, in addition I wish to illustrate, chiefly because the effect is the same in kind as one of great importance in nature. In our atmosphere you know floats carbonic acid gas, which furnishes food to the vegetable world. But this food could not be consumed by plants and vegetables without the intervention of the sun's rays. And yet, as far as we know, these rays are powerless upon the free carbonic acid of our atmosphere. The sun can only decompose the gas when it is drunk in by the leaves of plants. In the leaves it is in close proximity with substances ready to take advantage of the loosening of the molecules of the carbonic acid by the waves of light. Incipient disunion being introduced by the solar rays, the carbon of the gas is seized upon by the leaf and appropriated, while the oxygen is discharged into the atmosphere.

The experimental tube now before you contains a quantity of a different vapour from that which we have hitherto employed. The liquid from which this vapour is derived is called the nitrite of butyl. On sending the electric beam through the vapour, which has been carried in by air, the chemical action is scarcely sensible. I add to the vapour a quantity of air which has been permitted to bubble through hydrochloric acid. When the beam is now turned on, so rapid is the action, and so dense the clouds precipitated, that you could hardly by an effort of attention observe the dark interval which preceded the precipitation of the cloud. This enormous augmentation of the action is due to the presence of the hydrochloric acid. Like the chlorophyl in the leaves of plants, it takes advantage of the loosening of the molecules of nitrite of butyl by the waves of the electric light.

In these experiments we have employed a luminous beam for two different purposes. A small portion of it has been devoted to the decomposition of our vapours, while the great body of the light has served to render luminous the clouds resulting from the decomposition. It is possible to impart to these clouds any required degree of tenuity, for it is in our power to limit at pleasure the amount of vapour in our experimental tube. When the quantity is duly limited, the precipitated particles are at first inconceivably small, defying the highest microscopic power to bring them within the range of vision. Probably their diameters might then be expressed in millionths of an inch. They grow gradually, and as they augment in size, throw from them, by reflection, a continually increasing quantity of wave-motion, until, finally, the cloud which they form becomes so luminous as to fill this theatre with light. During the growth of the particles the most splendid iridescences are often exhibited. Such I have

sometimes seen with delight and wonder in the atmosphere of the Alps, but never anything so gorgeous as those which our laboratory experiments reveal. It is not, however, with the iridescences, however beautiful they may be, that we have now to occupy our thoughts, but with other effects which bear upon the two great standing enigmas of meteorology—the colour of the sky and the polarisation of its light.

And here let me briefly say that, were it not for the stimulus imparted to me by the private correspondence of a celebrated man, I should not have entered upon the investigation of these subjects so soon. In reference to the effects of light which you have just witnessed, Sir John Herschel wrote to me thus:—"It is a class of radiations eminently calculated to set one thinking, and it seems to have had that effect upon you to excellent purpose. I am glad it has brought you into contact with the blue colour of the sky; still more so if it should lead you to any satisfactory explanation of the polarisation of sky-light." The letter went on to treat of "this mysterious and beautiful phenomenon" in a manner which excited in me the strong desire to throw, if possible, some certain light upon a question regarding which the most divergent opinions and speculations were afloat among our most eminent scientific men.

First, then, with regard to the colour of the sky; how is it produced, and can we not reproduce it? This colour has not the same origin as that of ordinary colouring matter, in which certain portions of the white solar light are extinguished, the colour of the substances being that of the portion which remains. A violet is blue because its molecular texture enables it to quench the green, yellow, and red constituents of white light, and to allow the blue free transmission. A geranium is red because its molecular texture is such as quenches all rays except the red. Such colours are called colours of absorption; but the hue of the sky is not of this character. The blue light of the sky is all *reflected* light, and were there nothing in our atmosphere competent to reflect the solar rays we should see no blue firmament, but should look into the darkness of infinite space. The reflection of the blue is effected by perfectly colourless particles. Smallness of size alone is requisite to ensure the selection and reflection of this colour. Of all the visual waves emitted by the sun, the shortest and smallest are those which correspond to the colour blue. On such waves small particles have more power than upon large ones, hence the predominance of blue colour in all light reflected from exceedingly small particles. The crimson glow of the Alps in the evening and in the morning is due, on the other hand, to *transmitted* light; that is to say, to light which in its passage through great atmospheric distances has its blue constituents sifted out of it by repeated reflection.

It is possible, as stated, by duly regulating the quantity of

vapour, to make our precipitated particles grow from an infinitesimal and altogether ultra-microscopic size to masses of sensible magnitude; and by means of these particles, in a certain stage of their growth, we can produce a blue which shall rival, if it does not transcend, that of the deepest and purest Italian sky. Let this point be in the first place established. Associated with our experimental tube is a barometer, the mercurial column of which now indicates that the tube is exhausted. Into the tube I introduce a quantity of the mixed air and nitrite of butyl vapour sufficient to depress the mercurial column one-twentieth of an inch; that is to say, the air and vapour together exert a pressure of one six-hundredth of an atmosphere. I now add a quantity of air and hydrochloric acid sufficient to depress the mercury half an inch further, and into this compound and highly attenuated atmosphere I discharge the beam of the electric light. The effect is slow; but gradually within the tube arises this splendid azure, which strengthens for a time, reaches a maximum of depth and purity, and then, as the particles grow larger, passes into whitish blue. This experiment is representative, and it illustrates a general principle. Various other colourless substances of the most diverse properties, optical and chemical, might be employed for this experiment. The *incipient cloud* in every case would exhibit this superb blue; thus proving to demonstration that particles of infinitesimal size, without any colour of their own, and irrespective of those optical properties exhibited by the substance in a massive state, are competent to produce the colour of the sky.

But there is another subject connected with our firmament, of a more subtle and recondite character than even its colour. I mean that "mysterious and beautiful phenomenon,"[1] the polarisation of the light of the sky. The polarity of a magnet consists in its *two-endedness*, both ends, or poles, acting in opposite ways. Polar forces, as most of you know, are those in which the duality of attraction and repulsion is manifested. And a kind of *two-sidedness*—noticed by Huygens, commented on by Newton, and discovered by a French philosopher, named Malus, in a beam of light which had been reflected from one of the windows of the Luxembourg Palace in Paris—receives the name of *polarisation*. We must now, however, attach a distinctness to the idea of a polarised beam, which its discoverers were not able to attach to it. For in their day men's thoughts were not sufficiently ripe, nor optical theory sufficiently advanced, to seize upon or express the physical meaning of polarisation. When a gun is fired, the explosion is propagated as a wave through the air. The shells of air, if I may use the term, surrounding the centre of concussion, are successively thrown into motion, each shell yielding up its motion to that in advance of it, and returning to its position of equilibrium.

(1) Herschel's "Meteorology," Art. 233.

Thus, while the *wave* travels through long distances, each individual particle of air concerned in its transmission performs merely a small excursion to and fro.[1] In the case of sound, the vibration of the air-particles are executed *in* the direction in which the sound travels. They are therefore called *longitudinal* vibrations. In the case of light, on the contrary, the vibrations are *transversal;* that is to say, the individual particles of æther move to and fro *across* the direction in which the light is propagated. In this respect waves of light resemble ordinary water-waves, more than waves of sound. In the case of an *ordinary* beam of light, the vibrations of the æther particles are executed *in every direction* perpendicular to it; but let the beam impinge obliquely, upon a plane glass surface, as in the case of Malus, the portion reflected will no longer have its particles vibrating in all directions round it. By the act of reflection, *if it occur at the proper angle*, the vibrations are all confined to a single plane, and light thus circumstanced is called *plane polarised light.*

A beam of light passing through ordinary glass executes its vibrations within the substance exactly as it would do in air, or in æther-filled space. Not so when it passes through many transparent crystals. For these have also their two-sidedness, the arrangement of their particles being such as to tolerate vibrations only in certain definite directions. There is the well-known crystal tourmaline, which shows a marked hostility to all vibrations executed at right angles to the axis of the crystal. It speedily extinguishes such vibrations, while those executed parallel to the axis are freely propagated. The consequence is, that a beam of light, after it has passed through any thickness of this crystal, emerges from it polarised. So also as regards the beautiful crystal known as Iceland spar, or as doubly-refracting spar. In one direction, but in one only, it shows the neutrality of glass; in all other directions it splits the beam of light passing through it into two distinct halves, both of which are perfectly polarised, their vibrations being executed in two planes, at right angles to each other.

It is possible by a suitable contrivance to get rid of one of the two polarised beams into which Iceland spar divides an ordinary beam of light. This was done so ingeniously and effectively by a man named Nicol, that the Iceland spar, cut in his fashion, is now universally known as Nicol's prism. Such a prism can polarise a beam of light, and if the beam, before it impinges on the prism be already polarised, in one position of the prism it is stopped, while in another position it is transmitted. Our way is now, to some extent, cleared towards an examination of the light of the sky. Looking at various points of the blue firmament through a Nicol's prism, and turning the prism round its axis, we soon notice variations

(1) "Lectures on Sound," p. 3. (Longmans.)

of the brightness of the sky. In certain positions of the spar, and from certain points of the firmament, the light appears to be wholly transmitted, while, looking at the same points, it is only necessary to turn the prism round its axis through an angle of ninety degrees to materially diminish the intensity of the light. On close scrutiny it is found that the difference produced by the rotation of the prism is greatest when the sky is regarded in a direction at right angles to that of the solar rays through the air. Let me describe a few actual observations made some days ago on Primrose Hill. The sun was near setting, and a few scattered neutral-tint clouds, which failed to catch the dying light, were floating in the air. When these were looked at across the track of the solar beams, it was possible by turning the Nicol round, to see them either as white clouds on a dark ground, or as dark clouds on a bright ground. In some of its positions the sky-light was in great part quenched by the Nicol, and then the clouds, projected against the darkness of space, appeared white. Turning the Nicol ninety degrees round its axis, the brightness of the sky was restored, and then the clouds became dark through contrast with this brightness.

Experiments of this kind prove that the blue light sent to us by the firmament is polarised, and that the direction of most perfect polarisation is perpendicular to the solar rays. Were the heavenly azure like the ordinary light of the sun, the turning of the prism would have no effect upon it; it would be transmitted equally during the entire rotation of the prism. The light of the sky is in great part quenched, because it is in great part polarised.

When a luminous beam impinges at the proper angle on a plane glass surface it is polarised by reflection. It is polarised, *in part*, by all oblique reflections; but at one particular angle, the reflected light is *perfectly polarised*. An exceedingly beautiful and simple law, discovered by Sir David Brewster, enables us readily to find *the polarising angle* of any substance whose refractive index is known. This law was discovered experimentally by Brewster; but the Wave Theory of light renders a complete reason for the law. A geometrical image of it is thus given. When a beam of light impinges obliquely upon a plate of glass it is in part reflected and in part refracted. At one particular incidence the reflected and the refracted portions of the beam are at right angles to each other. The angle of incidence is *then* the polarising angle. It varies with the refractive index of the substance; being for water $52\frac{1}{2}$, for glass $57\frac{1}{2}$, and for diamond 68 degrees.

And now we are prepared to comprehend the difficulties which have beset the question before us. It has been already stated that in order to obtain the most perfect polarisation of the firmamental light, the sky must be regarded in a direction at right

angles to the solar beams. This is sometimes expressed by saying that the place of maximum polarisation is at an angular distance of 90° from the sun. This angle, enclosed as it is between the direct and reflected rays, comprises both the angles of incidence and reflection. Hence the angle of incidence, which corresponds to the maximum polarisation of the sky, is half of 90°, or 45°. This is the atmospheric polarising angle, and the question is, what known substance possesses an index of refraction to correspond with this polarising angle? If we knew this substance, we might be tempted to conclude that particles of it, scattered in the atmosphere, produce the polarisation of the sky. "Were the angle of maximum polarisation," says Sir John Herschel, "76° (instead of 90°), we should look to *water*, or ice, as the reflecting body, however inconceivable the existence in a cloudless atmosphere, and a hot summer day of unevaporated particles of water." But a polarising angle of 45° corresponds to a refractive index of 1; this means that there is no refraction at all, in which case we ought to have no reflection. Brewster and others came to the conclusion that the reflection was from the particles of air themselves. Dr. Rubenson, of Upsala, made the angle inclosed between the direct and reflected beams 90° 2′; "the half of which," says Mr. Buchan, in his excellent little "Handy Book of Meteorology," "is so near the polarising angle of air as to leave no doubt that the light of the sky, as first stated by Brewster, is polarised by reflection from the particles of air." It is difficult to affix a physical meaning to this conclusion. If light be reflected, it must be at the common limiting surface of two media of different refrangibility. But to satisfy the law of Brewster, as Sir John Herschel remarks, "the reflection would have to be made *in* air *upon* air!" "The more the subject is considered," adds the celebrated philosopher last named, "the more it will be found beset with difficulties, and its explanation, when arrived at, will probably be found to carry with it that of the blue colour of the sky itself."

If you doubt the wisdom, acknowledge, at all events, the faith in your capacity which has caused me to bring a subject so entangled before you. I believe, however, that even the intellect which draws its strength and its associations from a totally different source, may have its interest excited in subjects like the present, dark and difficult though they be. I do not expect that you will all grasp the details of this discussion; but I think that everybody present will see the extremely important part hitherto played by the law of Brewster in speculations as to the colour and polarisation of the sky. This law leads to the extraordinary conclusion already announced, that the reflection takes place at the limiting surface of two media of the same refrangibility, where reflection could no more occur than it could occur in the very heart of an optically homogeneous

medium. I shall now seek to demonstrate in your presence, *firstly*, and in confirmation of our former experiments, that sky-blue may be produced by exceedingly minute particles of any kind of matter; *secondly*, that polarisation identical with that of the sky is produced by such particles; and *thirdly*, that matter in this fine state of division, where its particles are probably small in comparison with the height and span of a wave of light, releases itself completely from the law of Brewster; the direction of maximum polarisation being absolutely independent of the polarising angle as hitherto defined. Why this should be the case, the wave theory of light, to make itself complete, will have subsequently to explain.

Into this experimental tube, in the manner already described, I introduce a vapour which is decomposable by the waves of light. The mixed air and vapour are sufficient to depress the mercurial column one inch. I add to this mixture air, which has been permitted to bubble through dilute hydrochloric acid, until the column is depressed thirty inches: in other words, until the tube is full. And now I permit the electric beam to play upon the mixture. For some time nothing is seen. The chemical action is doubtless progressing, and condensation going on; but the condensing molecules have not yet coalesced to particles sufficiently large to reflect sensibly the waves of light. As before stated—and the statement rests upon an experimental basis—the particles here generated are at first so small that their diameters would probably have to be expressed in millionths of an inch; while to form each of these *particles* whole crowds of *molecules* are probably aggregated. Helped by such considerations the intellectual vision plunges more profoundly into atomic nature, and shows us, among other things, how far we are from the realisation of Newton's hope that the molecules might one day be seen by microscopes. While I am speaking, you observe this delicate blue colour forming and strengthening within the experimental tube. No sky-blue could exceed it in richness and purity. But the particles which produce this colour lie wholly beyond our microscopic range. A uniform colour is here developed, which has as little breach of continuity,—which yields as little evidence of the particles concerned in its production, as that yielded by a body whose colour is due to true molecular absorption. This blue is at first as deep and dark as the sky seen from the highest Alpine peaks, and for the same reason. But it grows gradually brighter, still maintaining its blueness, until at length a whitish tinge mingles with the pure azure; announcing that the particles are now no longer of that infinitesimal size which reflects the shortest waves alone.[1]

(1) Possibly a photographic impression might be taken long before the blue becomes visible, for the ultra-blue rays are first reflected.

The liquid here employed is the iodide of allyl,[1] but I might choose any one of a dozen substances here before me to produce the effect. You have seen what may be done with the nitrite of butyl. With nitrite of amyl, bisulphide of carbon, benzol, benzoic ether, &c., the same blue colour may be produced. In all cases, where matter slowly passes from the molecular to the massive state the transition is marked by the production of the blue. More than this:—you have seen me looking at the blue colour (I hardly like to call it a blue "cloud," its texture and properties are so different from ordinary clouds) through this bit of spar. This is a Nicol's prism, and I could wish one of them to be placed in the hands of each of you. Well, this blue that I have been regarding turns out to be, if I may use the expression, a bit of more perfect sky than the sky itself. When I look across the illuminating beam exactly as we look across the solar rays in the atmosphere, I obtain not only partial polarisation, but *perfect* polarisation. In one position of the Nicol the blue light seems to pass unimpeded to the eye; in the other it is absolutely cut off, the experimental tube being reduced to optical *emptiness*. Behind the experimental tube it is well to place a black surface, in order to prevent foreign light from troubling the eye. In one position of the Nicol this black surface is seen without softening or qualification; for the particles within the tube are themselves invisible, and the light which they reflect is quenched. If the light of the sky were polarised with the same perfection, on looking properly towards it through a Nicol we should meet, not the mild radiance of the firmament, but the unillumined blackness of space.

The construction of the Nicol is such that it permits to pass through it vibrations which are executed in a certain determinate direction, and these only. All vibrations executed at right angles to this direction are completely stopped: while components only of those executed obliquely to it are transmitted. It is easy, therefore, to see that from the position in which the Nicol must be held to transmit or to quench the light of our incipient cloud, we can infer the direction of the vibrations of that light. You will be able to picture those vibrations without difficulty. Suppose a line drawn from any point of the "cloud" perpendicular to the illuminating beam. The particles of æther along that line, which carry the light from the cloud to the eye, vibrate in a direction perpendicular both to the line and to the beam. And if any number of lines be drawn in the same way from the cloud, like the spokes of a wheel, the particles of æther along all of them oscillate in the same manner. Wherefore, if a *plane surface* be imagined cutting the incipient cloud at right angles to its length, the perfectly polarised vibrations discharged laterally will all be parallel to this surface. This, in fact, is the plane of vibration of

(1) For which I have to thank the obliging kindness of Dr. Maxwell Simpson, F.R.S.

the polarised light. Or you may suppose a circle drawn round the experimental tube, and a series of strings attached to various points of this circle. If all the cords be stretched as perpendiculars to the experimental tube, and caused to wriggle by a series of jerks imparted at right angles both to them and to the tube, the motion of the particles of the strings will then represent those of the particles of æther. A distinct image of those vibrations is now, I hope, within the reach of every person here present.

Our incipient blue cloud is a virtual Nicol's prism, and, between it and the real Nicol, we can produce all the effects obtainable between the polariser and analyser of a polariscope. When, for example, a thin plate of selenite, which is crystallised sulphate of lime, is placed between the Nicol and the incipient cloud, we obtain the splendid chromatic phenomena of polarised light. The colour of the gypsum-plate, as many of you know, depends upon its thickness. If this be uniform, the colour is uniform. If, on the contrary, the plate be wedge-shaped, thickening gradually and uniformly from edge to back, we have brilliant bands of colour produced parallel to the edge of the wedge. Perhaps the best form of plate for experiments of this character is that now in my hand, which was prepared for me some years ago by a man of genius in his way, the late Mr. Darker of Lambeth. It consists of a plate of selenite thin at the centre, and gradually thickening towards the circumference. Placing this film between the Nicol and the cloud, we obtain, instead of a series of parallel bands, a system of splendidly coloured rings. The colours are most vivid when the incipient cloud is looked at perpendicularly. Precisely the same phenomena are observed when we look at the blue firmament in a direction perpendicular to the solar rays.

We have thus far illuminated our incipient cloud with ordinary light, and found the portion of this light reflected laterally from the cloud in all directions round it to be perfectly polarised. We will now examine the effects produced when the light which illuminates the cloud is itself polarised. In front of the electric lamp, and between it and the experimental tube, is placed this fine Nicol's prism, which is sufficiently large to embrace and to polarise the entire beam. The prism is now placed so that the plane of vibration of the light emergent from it, and falling upon the cloud, is vertical. How does the cloud behave towards this light? This formless aggregate of infinitesimal particles, without definite structure, shows the two-sidedness of the light in the most striking manner. It is absolutely incompetent to reflect upwards or downwards, while it freely discharges the light horizontally, right and left. I turn the polarising Nicol so as to render the plane of vibration horizontal; the cloud now freely reflects the light vertically upwards and down-

wards, but it is absolutely incompetent to shed a ray horizontally to the right or left.

Fix your attention upon one of those reflecting particles. Figure it as a little sphere with the beam of the electric light impinging upon it. Let us call that diameter which coincides with the direction of the beam, the *axis* of the sphere; one of its *poles* would then be turned towards the light, and the other in the opposite direction. The equator of the little sphere would of course be midway between its poles. Now, conceive a parallel of latitude drawn upon the sphere at an angular distance of 45 degrees from the pole; that is to say, midway between the pole and the equator. Then what occurs with ordinary light is this: all the vibrations tangent to the little circle, which I have called a parallel of latitude, are reflected perfectly polarised; but all vibrations executed at right angles to the circle go unreflected through the little sphere. If, instead of ordinary light, we use polarised light, it is clear that at two opposite points of the little circle the vibrations are executed along the tangents, while at two other opposite points they are executed at right angles to the tangents. In the former case the particle *reflects* the light, in the latter it *transmits* the light unreflected. What is true of a single particle is true of all, and hence the inability of the incipient cloud formed of such particles to reflect light in two directions, while it freely reflects it in two others. The entire facts are now placed before you. The reflecting particle and the waves of æther are of course both beyond the range of the senses, but to the intellect the conceptions here introduced are just as easy as if, in illustration, I had pointed to the poles, equator, and parallel of latitude of an ordinary terrestrial globe.

Suppose the atmosphere of our planet to be surrounded by an envelope impervious to light, with an aperture on the sunward side, through which a solar beam could enter and cross our atmosphere. Surrounded on all sides by air not directly illuminated, the track of the sunlight would resemble that of the electric beam in a dark space filled with our incipient cloud. The course of the sunbeam would be *blue*, and it would discharge laterally in all directions round it, light in precisely the same polarised condition as that discharged from the incipient cloud. In fact, the azure revealed by the sunbeam would be the azure of such a cloud. And if, instead of permitting the ordinary light of the sun to enter the aperture, a Nicol's prism were placed there, which should polarise the sunlight on its entrance into our atmosphere, the particles producing the colour of the sky would act precisely like those of our incipient cloud. In two directions we should have the solar light reflected; in two others unreflected. In fact, out of such a solitary beam, traversing the unilluminated air, we should be able to extract every effect shown

by our incipient cloud. In the production of such clouds we virtually carry bits of the sky into our laboratories, and obtain with them all the effects obtainable in the open firmament of heaven.

And here, had not a sufficient strain been already imposed upon your minds, I might enter upon the description of a series of extraordinary effects observed when the particles of our incipient clouds are allowed to augment in size, so as to approach the condition of true cloudy matter. The selenite ring-system, already referred to, is a most delicate reagent for the detection of polarised light. When we look *normally*, or perpendicularly, at an incipient cloud, the colours of the rings are most vividly developed, a diminution of the colour being immediately apparent when the incipient cloud is regarded *obliquely*. But let us continue to look through the Nicol and selenite normally at the cloud: the particles augment in size, the cloud becomes coarser and whiter, the strength of the selenite colours becoming gradually feebler. At length the cloud ceases to discharge polarised light along the normal, and then the selenite colours entirely disappear. If *now* the cloud be regarded *obliquely* the colours are restored, very vividly, if not with their first vividness and clearness. Thus the cloud that has ceased to discharge polarised light at right angles to the illuminating beam, pours out such light copiously in oblique directions. The direction of maximum polarisation changes with the texture of the cloud.

But this is not all; and to understand, even partially, what remains, a word must be said regarding the appearance of the colours of our plate of selenite. If, as before stated, the plate be of uniform thickness, its hue in polarised light is uniform. Suppose, then, that by arranging the Nicol the colour of the plate is raised to its maximum brilliancy, and suppose the colour produced to be *green;* on turning the Nicol round its axis the green becomes fainter. When the angle of rotation amounts to 45 degrees the colour disappears; we then pass what may be called a neutral point, where the selenite behaves, not as a crystal, but as a bit of amorphous glass. Continuing the rotation, a colour reappears, but it is no longer green, but *red*. This attains its maximum at a distance of 45 degrees from the neutral point, or, in other words, at a distance of 90 degrees from the position which showed the green at its maximum. At a further distance of 45 degrees from the position of maximum red, the colour disappears a second time. We have there a second neutral point, beyond which the green comes again into view, attaining its maximum brilliancy at the end of a rotation of 180 degrees. By the rotation of the Nicol, therefore, through an angle of 90 degrees, we produce a colour *complementary* to that with which we started.

As may be inferred from this result, the selenite ring-system changes its character when the Nicol is turned. It is possible

to have the centre of the circle dark, the surrounding rings being vividly coloured. The turning of the Nicol through an angle of 90 degrees renders the centre bright, while every point occupied by a certain colour in the first instance is occupied by the *complement* of that colour in the second. But what am I aiming at in these long preliminary statements? I want to be able to say, with full assurance of being understood by everybody present, that a cloud may so alter its texture as to produce upon light an effect equivalent to the rotation of the Nicol through 90 degrees. By curious internal actions, not here to be described, the cloud in our experimental tube sometimes divides itself into sections of different textures. Some sections are coarser than others, while it often happens that some are iridescent to the naked eye, and others not. Looking normally at such a cloud through the selenite and Nicol, it often happens that in passing from section to section the whole character of the ring-system is changed. You start with a section producing a *dark* centre and a corresponding system of rings; you pass to another section through a neutral point, and find in that section the centre *bright*, and at the same radial distances find each of the first rings displaced by one of the complementary colour. Sometimes as many as four such reversions occur in the cloud of an experimental tube a yard long. Now, the changes here indicated mean that in passing from section to section of the cloud the plane of vibration of the polarised light turns suddenly through an angle of 90 degrees; this surprising change being entirely due to the different texture of the two parts of the cloud. If you ask me why this should occur, my reply is, I do not know. Nobody yet knows. But the onus rests with our present optical theories to furnish an explanation.

You will now be able to understand, as far as it is capable of being understood, a very beautiful effect which, under favourable circumstances, might be observed in our atmosphere. This experimental tube contains an inch of the iodide of allyl vapour, the remaining 29 inches necessary to fill the tube being air, which has bubbled through aqueous hydrochloric acid. Besides, therefore, the vapour of iodide of allyl, we have those of water and of acid within the tube. The light has been acting on the mixture for some time, a beautiful incipient blue cloud being formed. As before stated, the "incipient cloud" is wholly different in texture and optical properties from an ordinary cloud; but it is possible to precipitate the aqueous vapour within this tube so as to cause it to form a cloud similar to the clouds of our atmosphere. This new and real cloud will be precipitated in the midst of the azure of the incipient cloud. An exhausted vessel of about one-third of the capacity of the experimental tube is now connected with the tube, the passage uniting

both being closed by a stop-cock. On opening this cock the mixed air and vapour will rush from the experimental tube into the empty vessel; and, in consequence of the chilling due to rarefaction, the vapour in the experimental tube will fall together as a true cloud. You are now prepared for the experiment. I first look at this blue colour, so as to obtain a vivid ring-system with a dark centre. Turning on the cock, the air is rarefied and the cloud precipitated. What is the result? Instantly the centre of the system of coloured rings becomes bright, and the whole series of colours corresponding to definite radial distances, complementary. While I continue to look at the cloud, it gradually melts away as an atmospheric cloud might do in the azure of heaven. And *there* is our azure also remaining behind. The coarser cloud seems drawn aside like a veil, the blue reappears, the first ring-system, with its dark centre and correspondingly coloured circles, being restored.

Thus patiently and bravely you have accompanied me over a piece of exceedingly difficult ground; and I think, as a prudent guide, we ought to halt upon the eminence we have now attained. We might go higher, but the boulders begin here to be very rough. At a future day we shall, I doubt not, be able to overcome this difficulty, and to reach together a greater elevation.

JOHN TYNDALL.

CRITICAL NOTICES.

TRAVEL AND ADVENTURE IN THE TERRITORY OF ALASKA, AND IN VARIOUS OTHER PARTS OF THE NORTH PACIFIC. By FREDERICK WHYMPER. With Map and Illustrations. London: John Murray. 1868. 16*s*.

MR. WHYMPER deserves well of the public for the preparation of this volume. If it is hardly of first-rate interest, that is the fault of the subject, and not his own, as he has made the best of his materials. The subject happens to be one on which information even of a negative kind was wanted, and he is entitled to our gratitude for working it up thoroughly, although he might personally have gained more credit by investing his talents and energy in some more attractive field. Those who desire to do so may now learn with ease almost all that can be known about Russian America. Mr. Whymper was in San Francisco when Colonel Bulkley's party was being organised to explore Russian America and a portion of Eastern Siberia, for the purpose of establishing a telegraph-line between the New and Old Worlds, *viâ* Behring's Straits; and he was tempted to join the expedition as artist. This party commenced operations in 1865, and was not broken up till the beginning of 1867, when the news of the laying of the Atlantic Cable reached the hardy pioneers, telling them that their enterprise was superseded. In this way, just before the cession to the United States, Mr. Whymper examined almost the entire region about which curiosity was suddenly aroused; and he was also able to learn a good deal, both from his own observation and the notes of fellow-explorers of the Northern Pacific region—that is the eastern portion of Russian Siberia, British Columbia, and Vancouver's Island, as well as California and Oregon in the United States. The result of his impressions is, that the Americans have made a pretty good bargain. The northern part of Alaska may not be worth very much, but in the lower part there is a good deal of available timber and minerals, which an enterprising race may make something of; while the trade in furs and fish may be turned to far more account than it has been in the somewhat careless keeping of a Russian company. As to the trade in fish especially, there are productive cod fisheries off the Oleatian islands, and the rivers abound in salmon, which may be caught, and pickled, and sent to California or Europe at little more than the cost of freight. The territory, in addition, will be useful to the Americans, as their whalers in the North Pacific will visit it more readily than they could do when their visits interfered with the trading monopoly of a foreign company. The acquisition was really a convenient one for the Americans on this account. Curiosity as to Alaska satisfied, it is to be feared, there will be very little care to study what Mr. Whymper has to say on other topics, though these are not without interest. The information about the natives, their connection with the natives of Eastern Asia, and the points of resemblance between them and the Esquimaux, is of considerable value. The descriptions of scenery are also fresh and striking, and bring before us a new Arctic region. The account of the mighty Yukon, a mile and a quarter wide, for nearly 2,000 miles from its mouth, frozen over in winter, but rushing down in summer with a deep and rapid current, enclosed in a valley of rocks, and ice, and snow, with forests of stunted fir standing out in summer when the snow has melted, presents a scene of desolate grandeur, which is, perhaps, not surpassed throughout the frozen north. Mr. Whymper, again, has collected several interesting notes of

early Russian voyages to the Northern Pacific. The account of California and San Francisco is both sketchy and flippant, but it has the merit of being recent, and may serve to familiarise English readers with some facts which it is useful to know relating to that remarkable region, and the remarkable people by whom it is now occupied.

Treating of Alaska it is hardly possible to avoid some reference to the motive of the United States in the purchase, and the Monro doctrine which it carries out another step. Mr. Whymper only glances at it once, and, no doubt to the surprise of some readers, very quietly accepts the Monro doctrine. He assumes that it will be a good, and not a bad, thing to let the United States have the North American continent to grow in, and that if they meant to intimate their inclination in that direction by obtaining the cession of Alaska there is no reason why England should be annoyed at the hint. Whether or not England has a real interest in assenting to the Monro doctrine in its most extreme form, it would seem a little doubtful whether the interests of the United States and of Russia have been made so entirely one by the cession of Alaska as was at first supposed. The interpretation of the transaction was—America for the Americans, Asia for the Russians, the two Powers to be in alliance for the policy thus expressed. But will the Russians be left undisturbed in Asia by the irrepressible Yankee, or rather his Californian descendant—still more shrewd and pushing, and settled in absolutely the finest territory, with the finest climate in the whole Union? It seems a mistake at least to take this for granted, though the dawn of a new conflict of races in the Northern Pacific is perhaps not more than discernible. What is certain is, that there is nothing thereabouts to stand against the Californian, who is likely to grow, and will rule or displace others wherever he plants his foot. San Francisco, the Californian capital, is the capital of the whole region, drawing to it the trade of North-Eastern Asia as well as Alaska, and swiftly gaining influence over Japan and China. It will be only in the natural course of things if in a very few years, when Alaska is well "exploited," and the west of the United States is a little more filled up, and the Atlantic and Pacific railways have multiplied the population and resources of California, the cession of Alaska should be followed by the cession, voluntary or enforced, of the whole of North-Eastern Asia. The Californians, in a word, are likely to cross over into Asiatic Russia and settle there, turning the Amour valley and the fertile wastes of Manchuria into a new Far West. The colonising power of the Russ is nothing to that of the Western Men; and it is not difficult to predict how the conflict, once engaged in, will end. The Californian opportunity is besides far greater than the Russian. It will be many years before Russia has speedy and cheap communication with the Amour. Her most hopeful plan of colonising there is to send emigrant ships from St. Petersburg by the Cape of Good Hope or Cape Horn, arriving at Nicolaieff after a voyage of six months or more. San Francisco, on the contrary, is almost at hand—little more than a three weeks' voyage being the actual interval, which will certainly be diminished with the growth of the China trade. Looking to our own relations with Russia in Asia it is rather a fortunate thing for us to have the prospect of a conflict of interest in North-Eastern Asia between our rival and a Power with which we may easily be united in the closest political alliance, as we are already united by the kinship of race and the strongest commercial interests.

ROBERT GIFFEN.

SOME BOOKS OF THE MONTH.

Lives of the Tudor Princesses. By AGNES STRICKLAND. London: Longmans. 12*s.* 6*d.*

WE should like to know how many persons who would be very offended if they were said not to be decently educated, could tell off-hand what were Lady Jane Gray's pretensions to the English crown? Or, why Lady Arabella Stuart's marriage with William Seymour created such stir in the reign of James I.? For that matter, it is not everybody who has taken a degree at Oxford or Cambridge who could tell you, without referring to a book, how it was that James I. himself came to succeed the great Elizabeth. Miss Strickland's new volume will remind some and inform others that Henry VIII. had two sisters: Margaret, the elder, married the King of Scotland for her first husband, and a Scotch nobleman for a second. Mary Tudor, the younger, married first Louis XII. of France, and then Charles Brandon, Duke of Suffolk, by whom she had two daughters. From them came in turn four more daughters, Ladies Jane, Katherine, and Mary Gray, and Lady Margaret Clifford, the story of whose lives, together with that of Mary Tudor, their grandmother, Miss Strickland has told in her now well-known manner, which is lively, gossiping, and at least as full of decided feeling as is compatible with the ideal serenity of history. Besides these descendants of Henry VII. in the younger female line, she has told over again the story of Arabella Stuart, his descendant in the elder line through Margaret, and whose romantic marriage with Seymour, grandson of Katherine Gray, united both lines.

Sartor Resartus. By THOMAS CARLYLE. London: Chapman and Hall. 1869. 7*s.* 6*d.*

THIS is the first volume of the Library Edition of Mr. Carlyle's writings, and deserves a word of greeting. The book itself, first written nearly forty years ago, is perhaps the most truly characteristic of all its author's pieces, and it is certainly that which has exerted most of the characteristically Carlylian influence, in its best form. There are not a few among us for whom the first reading of "the Everlasting Yea" marked an era in life, and even the heartiest dissidence from the panegyrics of Napoleon, of Frederick William, of Frederick II., and from the retrograde and essentially demoralising political doctrine preached within the last four or five years, fails to obliterate reverence and gratitude for the ancient teacher who supplied a more than religious stimulus towards sincerity of life and impersonality of purpose. It is not wholly amusing now to read the ever-famous epitaph of "Philippus Zaehdarm, Cognomine Magnus," because we remember that it was to such as he, the *aristos*, that the writer of the epitaph has in these last days bidden Englishmen look for government. Truly, the old is better. And its value remains unimpaired. The Library Edition, which is to be completed in thirty volumes, is handsomely printed, and convenient.

Under the Willows, and other Poems. By JAMES RUSSELL LOWELL. Macmillan. 6*s.*

MR. LOWELL'S new volume is not in that vein which has made him most popular in this country, but readers of his earlier and more generally serious poems will be glad to meet him again on the old ground belonging to the reflective Muse. They will find that with maturity of years has come a firmer method of treatment. A certain tendency which Mr. Lowell once had to something like inflation, to excess of leafage over fruit, has disappeared, and his

verse is now marked by a genuine poetic compactness. "Under the Willows," and the "Commemoration Ode," are nearly of the highest order, each in its kind; the first as a pleasant summer idyll, and the second as a matured lyric. The latter, indeed, is perhaps more than nearly—is altogether of the highest order, and among other things it may convince Englishmen in a way which a misappreciated political action has failed to do, of the intenseness of that sentiment which makes America a great nationality. Besides these two larger poems, the volume contains many slighter poems, all graceful and melodious.

Explorations of the Highlands of the Brazil; with a full account of the Gold and Diamond Mines; also, Canoeing down 1,500 Miles of the great river Sâo Francisco from Sabarà to the Sea. By Captain RICHARD F. BURTON. Two Volumes, with Maps and Illustrations. London: Tinsley Brothers. 1869. 30*s.*

THOUGH much too minute in its record to general readers, who have been used to accompany the jaunty traveller round all English-speaking countries, in a couple of not very big volumes, Captain Burton's new book will have its value for geographers, naturalists, and anybody who is ever likely to travel in Brazil. It is, in fact, a very closely-kept diary of rather monotonous canoeing, marching, and so forth. Luckily, the author has a spirited, or even an audacious style, and in the most out-of-the-way places in the world, he keeps his eye upon his native land, the condition and the prevailing social ideas of which he is not fond of sparing. Still, the book is much too long to attract an exoteric, that is, a non-Brazilian public.

The Life and Labours in Art and Archæology of George Petrie. By WILLIAM STOKES, M.D., D.C.L. Oxon. London: Longmans. 1868. 12*s.* 6*d.*

DR. PETRIE, who died a couple of years ago, was distinguished principally as an ardent and successful inquirer into the mysteries of Irish archæology. As a rule, unfortunately, ardour of this kind has almost invariably taken a romantic, high-flying, and inflammatory direction in Ireland. Petrie, on the contrary, was emphatically scientific, and he therefore looked upon the highly interesting archæological problems of Irish antiquity without any eye to the internal politics of to-day. The present volume is an account by a writer who is more conspicuous than Petrie was, and in a more conspicuous science, of Petrie's life and labours. To the general public it will hardly prove interesting; but the English student of archæology, and all Irishmen, will be attracted by a careful narrative, a little too long and detailed, perhaps, but full of matter.

Biographical Sketches. By HARRIET MARTINEAU. London: Macmillan. 8*s.* 6*d.*

A SERIES of short biographies of conspicuous personages who have died within the last sixteen years. They originally appeared in the columns of the *Daily News*, and considering that our contemporaries are usually those of whom we know least, in the first place, and that these brief sketches are remarkably well done, in the second, with ample knowledge, with much acuteness of analysis, and with a robust impartiality, their usefulness and interest are obvious. Miss Martineau's large literary power, and her fine intellectual training make these little sketches more instructive, and constitute them more genuinely works of art, than many more ambitious and diffuse biographies. Their only defect is one naturally incident to the form in which they first appeared—a tendency to allude to circumstances as familiar to the reader, which will daily drop more and more out of our minds.